17-1928

United States Court of Appeals for the Federal Circuit

RICHARD J BAKER,

Plaintiff-Appellant,

v.

MICROSOFT CORPORATION; et al.,

Defendants-Appellees.

On Appeal from the United States District Court
for the Western District of Washington
No. 2:16-cv-00396-RAJ -THE
The Honorable Richard A Jones, Judge

APPELLANT-APPENDIX Vol. 1

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Pro Se Plaintiff-Appellant

Baker v Microsoft Corporation; et al.,
Case No 17-1928

HONORABLE RICHARD A. JONES

UNITED STATES DISTRICT COURT
WESTERN DISTRICT OF WASHINGTON
AT SEATTLE

RICHARD J. BAKER, Plaintiff, v. MICROSOFT CORPORATION, et al., Defendants.	Case No. C16-396RAJ ORDER GRANTING DEFENDANTS' MOTION FOR SUMMARY JUDGMENT

I. INTRODUCTION

This matter comes before the Court on Defendants Microsoft Corporation, Electronic Arts Inc., Harmonix Music Systems, Inc., Majesco Entertainment Co., Ubisoft Inc., and Nintendo of America Inc.'s (collectively "Defendants") Motion for Summary Judgment. Dkt. # 130. Plaintiff Richard Baker ("Mr. Baker") alleges that Defendants' products infringe United States Patent No. 5,486,001 (the "'001 Patent"), a patent issued to him in 1996. Dkt. #44 at 3-4. Defendants contend they are entitled to summary judgment because the accused products do not come within the scope of Mr. Baker's patent. Dkt. #130 at 16-21. Mr. Baker disputes Defendants' interpretation of the '001 Patent and argues that Defendants' products, when combined, literally infringe upon the '001 Patent. Dkt. #133 at 22. Alternatively, Mr. Baker argues that the doctrine of equivalents applies and warrants a finding of infringement. Dkts. #129 at 15 and #133 at 24-26. The Court, having reviewed the record before it, GRANTS Defendants' motion.

II. BACKGROUND

In 1992 Richard Baker filed a patent application, Application No. 146,016, with the United States Patent and Trademark Office ("USPTO"). Dkts. #131, Ex. 3 at 2, and #133 at 8-9. The application described a personalized instructional aid that captured visual images representative of a person's movement, stored those visual images, compared those visual images to exemplary movements stored in a database, and then generated adjusted visual images to help an user emulate the exemplary movement. Dkt. #131, Ex. 4 at 23-27. Application No. 146,016 was rejected. *Id*., Ex. 5.

Besides failing for indefiniteness under 35 U.S.C. § 112, the USPTO rejected Mr. Baker's proposed claims because they were anticipated by United States Patent No. 5,184,295 (the "Mann Patent"), and because several claims were obvious when the Mann Patent was combined with other prior art. *Id*. at 5-8. In its 35 U.S.C § 102(a) and (e) rejections, the Patent Examiner concluded that the Mann Patent "includes the steps of capturing and storing visual image signals representative of a particular movement, comparing said captured image signals with stored image signals of a preferred movement, and generating further video image signals based on the original signals." *Id*. at 4.

Following the USPTO's initial rejection, Mr. Baker amended his patent application. Dkt. #131, Ex. 1. Mr. Baker amended his proposed patent claims by adding limitations indicating that the image capturing device of his personalized instructional aid was to be located "at a first location," while the place for storage, comparison, and generation of further video image signals was too occur "at a second location remote from said first location in a data base of a computer . . . ." *Id.* at 9-14. To support his amendments, Mr. Baker argued that the "separation or remoteness" between the location of the '001 Patent's image capturing device and the location of the computer system (where the comparison and analysis of the captured image signals takes place) precluded anticipation by the Mann Patent and other prior art. *Id.* at 18-19. Mr. Baker explained, "[n]owhere in Mann is there a teaching that the computer system is located remotely from the teaching station as is emphasized in Applicant's disclosure, wherein the primary images are formed in one location for instruction such as a studio or an aircraft." *Id.* at 18. The '001 Patent's transmittance of captured images "to a separate location for analysis and feedback" was considered "critical in Applicant's invention, because the programming can be efficiently performed at the remote computer station." *Id.*

Following Mr. Baker's amendments, the USPTO allowed Mr. Baker's claims; the '001 Patent issued on January 23, 1996. Dkt. #131, Ex. 3. The '001 Patent includes method and apparatus claims, and it expired on January 23, 2013. Dkts. #44 at 4 and #131, Ex. 3 at 10-11.

After the '001 Patent issued, Mr. Baker filed a Continuation-in-Part Patent application ("CIP Patent"). Dkt. #131, Ex. 6. The CIP Patent sought to expand the '001 Patent by allowing a computer, which the '001 Patent places at a second location remote from an image capturing device, to be located at the same location, or adjacent to, the image capturing device called for in the '001 Patent. Dkts. #131, Ex. 6 at 5, 21 and Dkt. #131, Ex. 3 at 10-11. All sixteen CIP Patent claims were not patentable due to prior art references and the CIP patent was rejected. Dkt. #131, Ex. 7 at 7.

Mr. Baker now accuses Defendants of infringing claims 1-5, 10-15, and 18-20 of the '001 Patent. Dkts. #44 at 3-16 and #129 at 2. Claims 1, 10, and 18 are independent claims. Dkt. #131, Ex. 3 at 10-11. Claims 1 and 10 require "capturing" and "storing" visual image signals at a "first location." *Id*. at 10. The captured visual images are then transmitted to a "second location remote from the first location" where those images are stored. *Id*. Claim 18 requires a means for "visually scanning, sensing and capturing visual and informational data signals representative of a particular target," a means for "storing said representative visual and informational data signals," and a means for "transmitting said representative visual and information data signals to a remote location." *Id*. at 11. Claim 1 is a method claim, while Claims 10 and 18 are apparatus claims. *Id*. at 10-11.

Mr. Baker accuses these two product groups of infringement: (1) Microsoft's Kinect sensor and games that can be played on the Xbox 360 with the Kinect sensor; and (2) the Your Shape game and associated camera, as played on Nintendo's Wii console or a personal computer ("PC"). *See* Dkt. #132 ¶ 3. The cameras associated with these two groups are connected to their respective game consoles with a physical cable. *Id*. ¶¶ 7, 13, 17, 19.

Mr. Baker contends that combined use of the accused products infringes the '001 Patent claims. Dkt. #44 at 4. According to Mr. Baker, images are formed by the accused cameras, thereby satisfying the "capturing and storing initial visual image signals . . . at a first location" requirement of the '001 Patent claims. Dkt. #129 at 14-15. The "first location" required by the asserted claims is located where the "real world person is who wants personalized audio-visual advice or an object[.]" *Id*. at 15. Mr. Baker then accuses the Xbox360 console, the Nintendo Wii console, and PCs of "storing preferred image signals representative of a selected preferred movement at a second location remote from said first location in a data base of a computer." *Id*. at 15. In his infringement contentions, Mr. Baker alleges that the accused cameras are at the "first location," while the Xbox 360 console, the Nintendo Wii console, and the PCs are the "second location remote from said first location." *Id*. at 14-15.

Defendants' motion for summary judgment is now before the Court.

III. SUMMARY JUDGMENT STANDARD

Summary judgment is appropriate where "the movant shows that there is no genuine dispute as to any material fact and the movant is entitled to judgment as a matter of law." Fed. R. Civ. P. 56(a); *Anderson v. Liberty Lobby, Inc.*, 477 U.S. 242, 247 (1986). When ruling on summary judgment, courts do not weigh evidence to determine the truth of the matter, but "only determine whether there is a genuine issue for trial." *Crane v. Conoco, Inc.*, 41 F.3d 547, 549 (9th Cir. 1994) (citing *Fed. Deposit Ins. Corp. v. O'Melveny & Meyers*, 969 F.2d 744, 747 (9th Cir. 1992), *rev'd on other grounds*, 512 U.S. 79 (1994)). Material facts are those which might affect the outcome of the suit under governing law. *Anderson*, 477 U.S. at 248.

Courts must draw all reasonable inferences in favor of the non-moving party. *See O'Melveny & Meyers*, 969 F.2d at 747. However, the nonmoving party must make a "sufficient showing on an essential element of her case with respect to which she has the burden of proof" to survive summary judgment. *Celotex Corp. v. Catrett*, 477 U.S. 317, 323 (1986). Further, "[t]he mere existence of a scintilla of evidence in support of the plaintiff's position will be insufficient; there must be evidence on which the jury could reasonably find for the plaintiff." *Anderson*, 477 U.S. at 252.

IV. DISCUSSION

Defendants seek summary judgment on three grounds. First, Defendants contend that Mr. Baker cannot prove their products literally infringe the '001 Patent. Dkt. #130 at 16-18. Defendants also contend that Mr. Baker's patent prosecution amendments and arguments preclude Mr. Baker's attempt to establish infringement under the doctrine of equivalents. *Id.* at

18-20. Finally, Defendants argue that Mr. Baker cannot rely on an "after-arising" theory to rely on the doctrine of equivalents. *Id.* at 20-21.

In response, Mr. Baker contends the accused products infringe the '001 Patent because a computer located in the same room as an image capturing device satisfies '001 Patent limitations which require that a computer be located at a "second location" that is "remote" from the "first location" in which an image capturing device is located. *See* Dkt. #129 at 2-3.

The Court agrees with Defendants and addresses each of the parties' arguments in turn.

A. Literal Infringement

Defendants contend their accused products do not literally infringe the '001 Patent because those products do not satisfy '001 Patent claim limitations which require that images captured in one location be transmitted to a "second location remote from the first location." Dkt. #130 at 16-17. According to Defendants, a "first location" and "second location remote from said first location" cannot be in the same room. *Id.* at 16-18. Because Defendants' accused products are within the same room, Defendants argue that their products do not literally infringe Claims 1, 10, and 18 of the '001 Patent. *Id.* Mr. Baker disagrees and argues that a computer located in the same room as the image-capturing device required by the '001 Patent can be considered "remote." Dkt. #133 at 19-23. In support of his argument, Mr. Baker relies on the prior construction of the term "remote location" in an unrelated patent. *Id.*

The Court agrees that Defendants' accused products do not literally infringe Claims 1, 10, and 18 of the '001 Patent. Determining whether literal infringement has occurred is a two-step process. *Vitronics Corp. v. Conceptronic, Inc.*, 90 F.3d 1576, 1581-82 (Fed. Cir. 1996). Courts must first determine the scope and meaning of a patent by properly construing its claims. *Id.* Once a patent's claims are construed, the Court must determine whether the accused products infringe the asserted claims. *Id*. Construction of Claims 1, 10, and 18, followed by a comparison of the construed claims with the accused products, support finding that Defendants' accused products do not literally infringe '001 Patent Claims 1, 10, and 18. [1]

i. Construction of Claims 1, 10, and 18 of the '001 Patent

The Court construes the term "remote" in Claims 1, 10, and 18 of the '001 Patent to require more than physical separation at the same location. The Court's construction is supported by the plain language of Claims 1, 10, and 18, the '001 Patent specification, and the prosecution history of the '001 Patent.

The limitation language of Claims 1, 10, and 18 indicates the existence of two separate locations. Claim 1 requires "capturing and storing initial visual image signals representative of a particular movement at a first location." Dkt. #131, Ex. 3 at 10. A separate limitation in Claim 1 then requires a computer database "at a second location remote from said first location," where "preferred image signals representative of a particular movement" are stored. *Id*. The separation between the "first" and "second" locations (which is required by four of the six limitations of Claim 1) is underscored by the inclusion of the word "remote," which indicates that the first and second locations are not in the same room.

Claim 10 similarly delineates between the capturing of visual image signals of a particular movement "at a first location," followed by the storage and comparison of the captured visual image signals "at a second location remote from said first location." *Id*. Claim 10 further requires a "means for regenerating further visual image signals of said particular movement," which are "adjusted in accordance with said selected preferred movement" to

[1] Because independent claims 1, 10, and 18 are not literally infringed, dependent claims 2-5, 11-15, and 19-20 are likewise not infringed. *See Kim v. ConAgra Foods, Inc.*, 465 F.3d 1312, 1316 n.1 (Fed. Cir. 2006) (dependent claims not infringed where court found noninfringement of corresponding independent claims).

allow an user to emulate the selected preferred movement "at said first location." *Id*. The separation between the "first" and "second" location is evidenced by the limitation in Claim 10 which indicates that a user can emulate the selected preferred movement "at said first location," while the captured visual image signals are compared at "said second location." This limitation indicates that the "first" and "second" location limitations refer to separate, distinct locations. Consequently, although Mr. Baker now argues that the "first" and "second" locations can be in the same room, the language evidenced by the limitations in Claim 10 indicates otherwise.

Claim 18, like Claims 1 and 10, also contains a limitation which requires that captured information be transmitted "to a remote location." Dkt. #131, Ex. 3 at 11. Like the meaning of "remote" in Claims 1 and 10, the Court construes the term "remote" in Claim 18 to require more than mere physical separation at the same location. *Phillips v. AWH Corp.*, 415 F.3d 1303, 1314 (Fed. Cir. 2005) ("Because claim terms are normally used consistently throughout the patent, the usage of a term in one claim can often illuminate the meaning of the same term in other claims.").

Patent '001's specification further indicates that the term "remote" refers to more than the physical separation of an image capturing device and a computer at the same location. In its "Summary of the Invention" section, the '001 Patent indicates that the computer where visual images of preferred movements are stored "is most preferably located at a remote location so as to be accessible from a number of different locations." Dkt. #131, Ex. 3 at 6. Using "remote" in this section envisions more than just physical separation within the same room, as is evidenced by the distinction between the "remote location" and the "number of different locations" from which the computer database can be reached. The "Detailed Description of the Preferred Embodiments" similarly describes a separation between where a user's movements are captured, and where a computer is located. *See id.* at 7-9. For instance, this part of the specification indicates that "[w]here recording of movements takes place, bio-informational data, may also be transmitted or collected." *Id.* at 7. As an alternative to collecting bio-information data "[w]here recording of movements takes place," the '001 Patent specification indicates that bio-mechanical signals "may also be obtained by various scanning, editing and digital techniques, used within a remote computer data base . . . once the signal has been received by the remote data base . . . ." *Id.* The distinction between the location where movements are recorded and where bio-mechanical signals are received by the "remote computer data base," further demonstrates that the term "remote" requires more than physical separation at the same location. That "remote" simply indicates physical separation between devices is further belied by the specification's description of the audio-visual signal transceiver required by the '001 Patent. *Id.*

The specification's use of the term "discrete" to describe the separation of units within the same room indicates that "remote" data bases cannot be within the same room as a user. The specification describes the image capturing device as "a unit discrete from the audio-visual signal transceiver and adapted to be connected thereto." *Id.* Alternatively, the image capturing device and audio-visual transceiver "may be one and the same, so that the image capturing device also incorporates a unit for transmission and reception of signals to and from remote data bases." *Id.* That "remote" requires more than physical separation between devices is also supported by a section in the specification which explains that the computer required by the '001 Patent is programmed to accept signals "from remote locations, associated with the audio-visual transceiver." That the locations associated with the audio-visual transceiver are "remote" implies those locations are separate and distinct from the "remote" locations where the computers are located. *Id*. at 8.

Patent prosecution history also confirms Mr. Baker's desire to differentiate his claims from prior art, which allowed placing an image capturing device and a computer database in the same location, by adding two separate locations. *See* Dkt. #131, Ex. 1 at 18 and Ex. 11 at 2-3, 29-31. Patentees "may limit the meaning of a claim term by making a clear and unmistakable disavowal of scope during prosecution." *Computer Docking Station Corp. v. Dell, Inc.*, 519 F.3d 1366, 1374 (Fed. Cir. 2008). When patentees "clearly characterize[e] the invention in a way to try to overcome rejections based on prior art," a disavowal of claim scope occurs. *Id*. Here, Mr. Baker disavowed the interpretation of "remote" he now seeks to use when he amended Claims 1 and 10 to include the "second location remote to the first location" language. *See* Dkt. #131, Ex. 1 at 9-12. To support this amendment, Mr. Baker argued that the "basic issue" distinguishing his patent from a prior art reference was "the separation or remoteness of the two basic components" of the '001 Patent. *Id*. at 18. Mr. Baker emphasized that while the images captured by the patent's image capturing device "are formed in one location for instruction such as a studio or an aircraft," the "[t]ransmittance to a separate location for analysis and feedback is critical . . . ." *Id*. This distinction between locales was deemed "critical," and Mr. Baker's arguments to support this distinction indicates that the term "remote" to distinguish between the two required locations requires more than just physical separation of the image capturing device and computer required by the '001 Patent.[2]

[2] Rejection of Mr. Baker's CIP Patent also supports the finding that "remote" refers to more than physical separation at the same location. The CIP Patent sought to expand the '001 Patent to allow a computer to be located at the same location, or adjacent to, the image capturing device called for in the '001 Patent. Dkt. #131, Ex. 6 at 5, 21 and Ex. 3 at 10-11. The USPTO rejected the CIP Patent due to prior art references.

Mr. Baker's reliance on a prior construction of the term "remote location" in an unrelated patent does not dissuade the Court from reaching its construction of the term "remote." A term construed a certain way in one patent "need not have the same meaning when used in an entirely separate patent, particularly one involving different technology." *Medrad, Inc. v. MRI Devices Corp.*, 401 F.3d 1313, 1318 (Fed. Cir. 2005). This is because, "the manner in which the term is used in the patent may dictate a definition that differs from the definition that would be given to the same term in a different patent with a different specification or prosecution history." *Id*. Here, Mr. Baker cites *Brookhill-Wilk 1, LLC. v. Intuitive Surgical, Inc.*, 334 F.3d 1294 (Fed. Cir. 2003), to argue that a "remote" location encompasses a setup where the computer required by the '001 Patent is located in the same room as the required image capturing device. Dkt. #133 at 23.

In *Brookhill*, the Federal Circuit considered a district court's construction of the term "remote location" as it was used in a patent that disclosed systems and methods for performing robotic surgery. 334 F.3d at 1296. The patent at issue included limitations which required the transmission of video signals "to a remote location beyond a range of direct manual contact." *Id*. Given the surrounding text of the claims in question, the other claims, the written description, and the prosecution history, the Federal Circuit determined that "remote location" did not only mean "a location outside the operating room." *Id*. at 1297, 1300-1302. The Federal Circuit reasoned that a "remote location" could include a location within an operating room because the patent's written description and prosecution history "fail[ed] to express a manifest exclusion or restriction limiting the claim term . . . ." *Id*. at 1301.

Here, the Court does not construe the term "remote" to include locations within the same room as the image capturing device required by the '001 Patent. As previously explained, the context in which the term "remote" is used in the '001 Patent, the '001 Patent specification, and the prosecution history all indicate that this term should not be read as broadly as the term was read in *Brookhill*.

ii. Claims 1, 10, and 18 of the '001 Patent Are Not Literally Infringed

Literal infringement exists when each of a patent's claim limitations are found in the accused products. *Allen Eng'g Corp. v. Bartell Indus., Inc.*, 299 F.3d 1336, 1345 (Fed. Cir. 2002). Patentees thus must prove that accused devices contain each limitation of the allegedly infringed claims. *E.g., Bayer AG v. Elan Pharm. Research Corp.*, 212 F.3d 1241, 1247 (Fed. Cir. 2000). "If any claim limitation is absent from the accused device, there is no literal infringement as a matter of law." *Id*. Consequently, upon finding the absence of one limitation courts need not address whether any other limitations are absent. *See Fin Control Sys. Pty, Ltd. v. OAM, Inc.*, 265 F.3d 1311, 1320 ("Because we find that the accused OAM systems fail to meet the 'lateral' and 'side' limitations of claim 13, we need not consider additional noninfringement arguments made by OAM."). To determine if literal infringement of claims expressed in means-plus-function language is present, "the court must compare the accused structure *with the disclosed structure*, and must find equivalent *structure* as well as *identity* of claimed *function* for that structure." *Pennwalt Corp. v. Durand-Wayland, Inc.*, 833 F.2d 931, 934 (Fed. Cir. 1987) (emphasis in original).

Defendants' accused products do not literally infringe Claim 1 of the '001 Patent. Here, the accused products, contrary to the limitations required by Claim 1, do not require the capturing of visual images "at a first location," followed by the subsequent storage of those images "at a second location remote from said first location." The Kinect Sensor and the USB camera are in the same room as the computer (in this case the accused game consoles and PCs) that stores, analyzes, and generates subsequent visual images. The accused game consoles and PCs are thus not located "at a second location remote from said first location." By design, the Kinect Sensor and USB camera are physically connected to the accused game consoles and PCs. Defendants' accused products likewise do not literally infringe the claim limitation which requires "transmitting said captured and stored visual image signals from said first location to said computer at said second location."

Claim 10 of the '001 Patent is also not literally infringed. Here, a Claim 10 limitation requires a "means for storing said captured visual image signals at a second location remote from said first location." The claimed function in this limitation requires storing of captured visual image signals at a second location remote from the first location. Here, Defendants' accused products are within the same room and the storage of signals "at a second location remote from said first location" does not occur. Because identity of function between the accused products and this Claim 10 limitation is lacking, literal infringement cannot be found.

Independent Claim 18 is likewise not literally infringed. Claim 18 requires a "means for transmitting said representative visual and informational data signals to a remote location." The '001 Patent's specification describes the corresponding structure to this recited means as an audio-visual transceiver that "may take the form of a portable signal unit or a personal computer." Dkt. #131, Ex. 3 at 7. The function claimed is the transmitting of the visual and informational data signals "to a remote location." The identical function of this Claim 18 limitation is not found in the accused products because those products are all within the same room as a user, and they do not transmit signals to a "remote" location. Because no identity of function exists between the accused products and this Claim 18 limitation, literal infringement cannot be found.

In summary, because Defendants' accused products do not contain each limitation of Claims 1, 10, and 18, the Court does not find literal infringement of those claims.

B. Infringement Under the Doctrine of Equivalents

Prosecution history estoppel bars Mr. Baker from relying on the doctrine of equivalents to demonstrate infringement. Under the doctrine of equivalents, a product or process that does not literally infringe a patent claim may nonetheless infringe if the elements of the accused product or process are equivalent to the claimed elements of a patent. *Warner-Jenkinson Co., Inc. v. Hilton Davis Chem. Co.*, 520 U.S. 17, 21 (1997). Plaintiffs alleging infringement must demonstrate that an accused product meets all of a patent claim's limitations. *See id*. at 29 ("Each element contained in a patent claim is deemed material to defining the scope of the patented invention, and thus the doctrine of equivalents must be applied to individual elements of the claim, not to the invention as a whole."). However, when a patentee narrows their claims to distinguish them from prior art, prosecution history estoppel may apply. *Biagro v. W. Sales, Inc. v. Grow More Inc.*, 423 F.3d 1296, 1305 (Fed. Cir. 2005). The narrowing of a claim in response to a patent application rejection thus estops a patentee from using the doctrine of equivalents to recapture matter surrendered between the original and amended claims. *Festo Corp. v. Shoketsu Kinzoku Kogyo Kabushiki Co., Ltd.*, 344 F.3d 1359, 1366-67 (Fed. Cir. 2003).

Here, Mr. Baker disclaimed the alleged equivalents during prosecution when the "second location remote from the first location" limitation language was added to Claims 1 and 10. Before Mr. Baker amended his patent application, the USPTO cited the Mann Reference, and other prior art, to reject Mr. Baker's application. Following this rejection, Mr. Baker's patent application was amended and the "second location remote from the first location" language was added to limitations in Claims 1 and 10. Because the "second location remote from the first location" language was added by Mr. Baker to overcome prior art rejections cited by the USPTO, Mr. Baker cannot now argue that the accused products' performance of the alleged claim steps in a single location is the equivalent of limitations amended to require two, separate locations.

Mr. Baker's arguments to support his amendments also demonstrate the applicability of prosecution history estoppel. To support his patent amendments, Mr. Baker emphasized the need for two separate locations in the '001 Patent. Dkt. #131, Ex.1 at 18-19. This emphasis on two separate locations forecloses Mr. Baker's current attempt to demonstrate infringement under the doctrine of equivalents.

The Court is also not persuaded by Mr. Baker's attempt to rely on prosecution history estoppel's unforeseeability exception to apply the doctrine of equivalents. Dkt. #133 at 23-24. Plaintiffs can rebut the presumption that an amendment disclaims matter surrendered between original and amended claims if they can demonstrate that an equivalent was unforeseeable at the time of their patent application. *Festo Corp. v. Shoketsu Kinzoku Kogyo Kabushiki Co., Ltd.*, 535 U.S. 722, 740-41 (2002)). Here, Mr. Baker contends that he could not have foreseen the possibility that subsequent technologies would evolve to where a personal computer, as opposed to a remote computer, could possess the properties to execute his patent claims. Dkt. #133 at 23-24. The Court is not persuaded by this argument. Prior art, specifically the Mann Patent, disclosed the steps of capturing, storing, comparing, and generating image signals of a preferred movement at a single location. Dkt. #131, Ex. 5 at 4 and Ex. 11 at 2-3, 29-31. Consequently, Mr. Baker is estopped from arguing that the accused products, which are all in the same room as a user, infringe under the doctrine of equivalents.

C. "After-Arising" Technologies

Finally, Defendants contend that Mr. Baker's reliance on an "after-arising" theory to argue for applying the doctrine of equivalents is misplaced. Dkt. #130 at 20-21. The doctrine of equivalents allows patent owners to cover after-arising technologies that are not foreseeable as available technology when a patent application is filed. *See Siemens Med. Solutions USA, Inc. v. Saint-Gobain Ceramics & Plastics, Inc.*, 647 F.3d 1373, 1376 (Rader, J., concurring) ("In other words, '[t]he applicant is charged with surrender of foreseeable equivalents known before the amendment, not equivalents known after the amendment.' Thus, the doctrine of equivalents allows patent owners to cover after-arising technology.") (quoting *Festo Corp. v. Shoketsu Kinzoku Kogyo Kabushiki Co., Ltd.*, 493 F.3d 1368, 1380 (Fed. Cir. 2007)). However, if a patent owner fails to claim an equivalent that is foreseeable as available technology, that subject matter enters the public domain. *Id.*

According to Defendants, the claim limitations they rely on to support summary judgment do not specify the kind, nor the speed, of the computer required by the '001 Patent; instead, these claim limitations merely require a computer at a "second location remote from the first location." Dkt. #130 at 20-21. Because the prosecution history estoppel analysis requires a court to address the claim limitations allegedly infringed by an accused product's equivalent limitation, Defendants argue that the Court is limited to considering whether the equivalence asserted by Mr. Baker is an after-arising technology. *Id.* at 21. Mr. Baker disagrees, but merely lists several of Defendants' accused products which allegedly were not developed until after Mr. Baker filed his patent application; Mr. Baker argues these products work in conjunction to infringe on claim limitations found in the '001 Patent. Dkt. #133 at 25-26.

The Court agrees that Defendants' accused products are not after-arising technologies encompassed by the '001 Patent's "remote" location limitations of Claims 1, 10, and 18. Here, Mr. Baker argues that a computer in the same room as an image capturing device can be considered "remote." Dkt. #133 at 19-23. Because this claim limitation does not specify the type of computer used, or the speed of that computer's transmissions, the only relevant question in determining whether an "after-arising" theory allows application of the doctrine of equivalents is whether placing an image capturing device and a computer in the same room is an "after-arising" technology. Given prior art references which allowed for performing similar claims in the same location, the Court finds that the "after-arising" theory does not allow application of the doctrine of equivalents.

V. CONCLUSION

Having reviewed the Defendants' motion for summary judgment, Mr. Baker's response in opposition thereto, and Defendants' reply, along with all supporting declarations, exhibits, and the remainder of the record, the Court GRANTS Defendants' motion for summary judgment.

DATED this 3rd of January, 2017.

The Honorable Richard A. Jones
United States District Judge

Hon.Richard A. Jones

[1]

UNITED STATES DISTRICT COURT
WESTERN DISTRICT OF WASHINGTON
AT SEATTLE

RICHARD J BAKER Plaintiff, v. MICROSOFT CORPORATION, et al., Defendant(s)	CASE NO. C16-396RAJ MOTION FOR LEAVE TO FILE OUTSIDE OF 14 DAYS MOTION FOR RECONSIDERATION NOTING DATE: 24TH JANUARY, 2017

[1] MOTION FOR LEAVE TO FILE OUTSIDE OF 14 DAYS MOTION FOR RECONSIDERATION

RICHARD J BAKER
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MOTION FOR LEAVE TO FILE OUTSIDE OF 14 DAYS

MOTION FOR RECONSIDERATION

TO ALL PARTIES AND TO THEIR COUNSEL OF RECORD:

PLEASE TAKE NOTICE that pursuant to Western District of Washington Civil Local Rule 7(h), Plaintiff Richard J Baker hereby move this Court for an order granting Leave to file a Motion For Reconsideration outside of 14 day requirement under Civil Local Rule 7(h)(2).

Plaintiff Richard J Baker respectfully asks the Honorable Court to grant this Order as new material fact evidence has come to light which shows specifically that not only can Plaintiff work his invention in "same room" as defendants accused systems, even on their accused games "computer" consoles, under his issued US Patent U.S.A. No. 5,486,001 claims, Defendants accused systems the way they work, even in "same room" are accessing a "remote computer" at a "second location" from where a persons motion is being capture via camera, "first location". All covered via Plaintiff issued patent claims for "Literal" & "Direct" infringement.

Plaintiff asks the Court for forgiveness in not filing Motion for Consideration within timely manner. He is Pro Se Litigant. Court did not believe any of Plaintiffs arguments put up in Opposition to Defendants Summary Judgment (Document filed 06/17/16 #130), he still believes where legitimate factual arguments. When the Honorable Court rejected all the arguments, Plaintiff then needed to find new factual evidence to support his case, which he has now found. This evidence took longer to find than 14 days and he had to study if Court Local Rules then allowed him to submit any document for consideration. LCR 7(h)(1) Motions for

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Reconsideration. Standard allows for showing of **new facts**.

This case has been reduced to where a "remote computer" can be located to other devices like Microsoft Kinect camera, that lots of people cannot really determine easily. Plaintiff can show "simply" now that his remote computer was approved to work under his US Patent Claims (a) in "same room" as a person whose motion was being captured via motion sensing camera, the way defendants accused systems work and also (b) in other places outside of a room.

Plaintiff asks for Leave to File Outside of 14 Days Motion for Consideration in the interest of justice and for good cause shown and especially to conserve this Court & Appellate Courts resources. Plaintiff only needs a few days, if Court will agree till 31 January, 2017 to draft and submit Motion for Consideration, this timing would also allow Plaintiff to file Notice of Appeal within 30 Days if Court see's no merit with his new evidence.

Plaintiff hopes Court may see merit and Grant Plaintiff request for Leave to File Outside of 14 Days Motion for Consideration.

Respectfully submitted,

Dated: January 24, 2017 By: /s/ Richard J Baker

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CERTIFICATE OF SERVICE

The undersigned hereby certifies that a true and correct copy of **PLAINTIFF RICHARD J BAKER'S MOTION FOR LEAVE TO FILE OUTSIDE OF 14 DAYS MOTION FOR RECONSIDERATION** has been served upon all counsel of record below, by CM/ECF filing, e-mail on January 24, 2017

Michelle Lyons Marriott, michelle.marriott@eriseIP.com - Ubisoft Counsel

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Sonal Mehta, SMehta@durietangri.com - Microsoft & Electronic Arts Counsel

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Hon.Richard A. Jones

UNITED STATES DISTRICT COURT
WESTERN DISTRICT OF WASHINGTON
AT SEATTLE

RICHARD J BAKER Plaintiff, v. MICROSOFT CORPORATION, et al., Defendant(s)	CASE NO. C16-396RAJ PLAINTIFFS' MOTION FOR RECONSIDERATION AND REVERSAL OF SUMMARY JUDGMENT UNDER FED.R.CIV.P.60(b) NEW EVIDENCE NOTING DATE: 17th FEBRUARY, 2017

PLAINTIFFS' MOTION FOR RECONSIDERATION AND REVERSAL OF SUMMARY JUDGMENT UNDER FED.R.CIV.P. 60(b) NEW EVIDENCE

Plaintiff Richard J Baker files this Motion for Reconsideration and Reversal of Summary Judgment under FRCP Rule 60(b)(2) new evidence and respectfully asks the Court to amend its Granting of Summary Judgment Order to Defendants and reverse this instant case back for trial in the interest of Justice and Courts resources.

Facts

On January 3, 2017 the Court issued Order Granting Defendants Summary Judgment (Dkt No. 135) and denied Plaintiffs' augments against Summary Judgment based on he was not

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entitled to work his U.S.A. No. 5,486,001 patent in "*same room*" as a person whose motion was being captured via motion tracking camera. Defendants asked for early Summary Judgment on this narrowly-tailored point and Plaintiff responded with

1. Brookhill-Wilk I. LLC. v. Intuitive Surgical, Inc case as a means to show Court "physical separation" of devices via a communications means *was enough* to allow Plaintiffs remote computer at a second location, which houses his inventive algorithm to work in same room as person having their motion captured via motion tracking camera at a first location, the way defendants accused systems work, but Court formed opinion against known *networking* of devices today, Dkt 135, Page 7 Line 5 - Page 9 Line 23 that Plaintiffs remote computer at a second location mentioned in the specification and claims required *more than physical separation* between devices. The Plaintiff very respectfully disagrees with the Honorable Richard A. Jones decision as there are many instances today where someone can connect to a remote computer and be in same room, example checking their email on a mobile phone over a communications *network*, the remote email server could be right next to a person and others can also connect to the same remote computer over a network from anywhere in the world.

Plaintiff also mentioned same as in Brookhill-Wilk I. LLC. v. Intuitive Surgical case his expert (virtual) like surgeon never touched person, so Plaintiffs technology could also work in same room. Plaintiff's expert virtual coach was in database of a computer. Court took no notice of this and dismissed findings in Brookhill-Wilk I. LLC. v. Intuitive Surgical as not being relevant to this case. If this case was not relevant Plaintiff would like Court to see Exhibit G, US Patent 8,270,604 B2 which is relevant to working of Plaintiffs invention. Here the inventors also talk about (a) camera at a first location Page 2 Line 34 (b) remote computer at second location, Page 1 Line 50 and both devices are separated via (c) a communications means, a network Page 1 line 52 and the USPTO examiner in 2012 never put any restrictions on where the inventors could work their invention, like Court has now done against Plaintiffs technology in

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Summary Judgment ruling. Also he never mentioned in the specification like these inventors (a) what sort of computer he was using or (b) how far away it was from camera.

2. Plaintiff also pointed out with Exhibit B filed with his Opposition of Defendants Motion for Summary Judgment of Non-Infringement, Dkt No 133 and within this document at Page 8 that the defendants camera device is in a first location, Xbox 360 & Wii Games console is in a second location remote from the first and both devices are linked via communications means, USB "networking" cable all spelled out in Plaintiff approved U.S.A. No. 5,486,001 patent claims. That the defendants were infringing Plaintiffs patent claims and his DOE & AAT rights working their systems in same room as motion capture camera but Court ruled his mentioning of using a *remote computer at a second location* for camera at first location in 1992 *must* put his remote computer outside of a room from motion capture camera which plainly wrong under a networking situation. Plaintiffs approved claims and specification cover just *physical separation of two devices* via a *communications* means with no mention of how far away these devices can be. Court ruled Plaintiffs patent claims cover Page 7, lines 10-11 *two separate locations* for devices as in one device can be in one room but the other has to be outside of the room. This interpretation of Plaintiffs approved claim by Court is incorrect when Plaintiff said *locations* referred to the *hardware devices only* and this formed the basis of Court awarding Summary Judgment to the defendants. The Court failed the plaintiff believes to view the facts in the proper light and failed to take the reasonable inferences favoring the Plaintiff I this regard.

There are a number of other points in the Courts Summary Judgment ruling whereby Plaintiff feels Court did not give enough attention to the good fact material evidence he presented but he will not raise these further points herein to save Courts valuable time, keep these points for Appellants opening brief. Main reason for this motion is to try to show the Honorable Court grave injustice has been done to Plaintiff which can be reversed and save Appeal Courts valuable time. This new evidence he was forced to find because Court

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misconstrued at Summary Judgment Grant to Defendants what was meant be hardware devices being in first and second locations. Only thing that matters as the Defendants point out and Court mentions on Page 6 of Order Granting Summary Judgment at Dkt. #130 at 16-17, According to Defendants, (which was the basis of their narrowly-tailored early motion for summary judgment) a "first location" and "second location remote from the said first location" *cannot* be in the same room. Id. At 16-18 Plaintiff shows below with his new evidence that the above structure when related to hardware devices working across a network, communication means in both the accused systems and Plaintiff approved patent claims can be in the same room.

Plaintiffs New Evidence for the Court supporting direct infringement. This information was forwarded to the defendants on 29th January, 2017.

How this comes about.

1. Both Plaintiff & Defendants systems use "Peripheral" device camera which connects to a Computer via a Communications means.

Peripheral (of a device) able to be attached to and used with a computer, though **not an integral part of it**

Baker said in his U.S.A. No. 5,486,001 patent claims camera was at "first location" which is correct if it's not *physically* attached to a computer, and both are connected via communication means. (Evidence given to Court Dkt No 133 Page 8) Defendants accused systems also use peripheral device camera.

2. If peripheral device camera is in a *first location* then this device which connects to a computer via a communications means mentioned in U.S.A. No. 5,486,001 would place

 PLAINTIFFS MOTION FOR RECONSIDERATION AND REVERSAL OF SUMMARY JUDGMENT UNDER FED.R.CIV.P.60(b) NEW EVIDENCE

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computer it connects to at a “second location” “remote” from first, correctly identified in Baker’s U.S.A. No. 5,486,001 patent claims. It’s a “remote computer”. Defendants accused systems because they also use peripheral device camera and connect it to computer, games console are actually connecting to a *remote computer* at *second location* mentioned in Plaintiffs U.S.A. No. 5,486,001 claims.

3. Now where can Baker produce his invention knowing that his remote computer only has to be “separated” from peripheral device camera, using a “communications” means and he makes no mention in U.S.A. No. 5,486,001 of what type of computer is used, only that it is *remote*?

This all depends on what type of computer Baker’s peripheral device camera is connecting to via communications means. If it’s a PC or Games Console computer that most people have in the home, then this computer is likely to be in very close proximity to person whose motion was being captured by peripheral device camera, so plaintiffs invention, algorithm as approved by USPTO could be generated, shown via association with a PC or Games Console computer in single “same room” as person whose motion was being captured via peripheral device camera. Defendants accused systems work this way so they then directly infringe all of plaintiffs U.S.A. No. 5,486,001 patent claims.

If the computer being connected to via peripheral device camera was a Server or Mainframe. Most people do not usually have one of these in the home, this computer is likely to be outside of a room where a person was having their motion captured via peripheral device camera, so U.S.A. No. 5,486,001 patent claims also allow Plaintiff to work his invention outside of signal room as well, basically anywhere.

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The above shows going on Plaintiffs issued U.S.A. No. 5,486,001 patent claims, the devices and the wording of the claims he was approved to operate his invention by the USPTO anywhere and on any computer in 1996.

Further to the above Plaintiff submits with this motion Exhibit H, Microsoft's own US20100199228 A1 "Gesture Keyboarding" patent application which relates to the Kinect camera used in Microsoft's accused system with third party software in this instant case and Exhibit I, Microsoft US 8,418,085 B2 "Gesture Coach" patent approved by USPTO in 2013 that Microsoft claims allowed them to work their invention in same room over the Plaintiffs prior art.

US 8,418,085 B2 reads on at Page 6 Line 60 – Page 7 Line 2, the "capture device" 20 may be in communication with the computing environment 12 via a "communication" link 36. The communication link 36 may be a wired connection including, for example, a "USB connection", a Firewire connection, an Ethernet cable connection, or the like and/or a wireless connection such as a wireless 802.11b, g, a, or n connection. According to one embodiment, the computing environment 12 may provide a clock to the capture device 20 that may be used to determine when to capture, for example, a scene via the communication link 36. Then on Page 17 Line 36- The computer 241 may operate in a "networked" environment using logical connections to one or more "*remote computers, such as a remote computer 246* .

Peripheral device Camera as Plaintiff has mentioned works in a networking environment to a remote computer at a second location

US20100199228 reads on at Page 5 [0056] The remote computer 246 may be a *personal computer*, a server, a router, a network PC, a peer device or other common network node", and typically includes many or all of the elements described above relative to the computer 241. The extract statement as on Page 17 from line 36 – 42 in US 8,418,085 B2 "Gesture Coach" patent, so Microsoft accused system is actually connecting Peripheral device camera up, as Plaintiff has

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been saying to a remote computer in same room and Microsoft employees go on in this Gesture Coach patent to being able to get the USPTO to issue them with Plaintiffs inventive algorithm again, which allows a computer to automatically make personalised audio-visual instructional video for a person by this statement at page 25 from lines 42-52

FIGS. 7A-7C depict **a *split-screen display of the visual representation of the user and the instructional gesture data*,** it is contemplated that the instructional gesture data may be provided in any suitable form. For example, rather than a split screen, just the left side of the split-screen in FIGS. 7A-7C may be displayed to highlight the errors in the user's gesture. The errors are highlighted, in this example, as arrows that point to the deviation of the user's gesture. In another example, or combined with another form of instructional gesture data, ***auditory assistance such as a voice-over could verbalize the errors or possible corrections for the user***

The above was after the Plaintiffs put Microsoft & USPTO on notice with a Rule 99 submission in 2011 of his issued U.S.A. No. 5,486,001 patent being in place Microsoft employees still went ahead and got his patent working issued again in US 8,418,085 B2 "Gesture Coach by the USPTO. Plaintiff feels that the question of where something *remote* can be from another device in the computer industry can lead people to a number of conclusions unless they consider all the facts.

Plaintiff believes it was unintentional failure of the Court to notice or consider a particular property of a device, the peripheral device camera could stratify Plaintiffs claim of "first location", then computer does become remote at a second location", then if the defendants are communicating, networking from one device to the other, computer can be anywhere, bringing the Defendants accused systems under the Plaintiff issued U.S.A. No. 5,486,001 patent

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claims.

Fed. R. Civ. P. 60(b)(2) - Relief Based Upon Newly Discovered Evidence.

Fed. R. Civ. P. 60(b)(2) provides that a party may be relieved from a final order if the party obtains "newly discovered evidence that, with reasonable diligence, could not have been discovered in time to move for a new trial under Rule 59(b)." Under Rule 60(b)(2), Plaintiff's motion is subject to the one-year time limitation to bring a motion under this ground. Fed. R. Civ. P. 60(c)(1). To consider the new evidence, the Court must find that the earlier absence of the evidence is excusable under the "newly discovered evidence" standards under Rule 60(b)(2), which only applies to "evidence which by due diligence could not have been discovered in time to move for a new trial under Rule 59(b)." Judicial economy favours correction of mistakes as early as possible, before costly and time-consuming appeals begin. This now is what the Plaintiff is trying to achieve. This new evidence only came to light after the Court dismissed Plaintiffs valid arguments that his invention could work in same room as defendants systems under his issued U.S.A. No. 5,486,001 patent claims or his pioneer inventor DOE & AAT rights.

Prayer

The Plaintiff hopes the Honorable Court will look on this new evidence favourably and reverse Summary Judgment, send this case back for trial, for justice and consideration of court resources.

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Respectfully submitted,

Dated: February 9, 2017 By: /s/ Richard J Baker

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CERTIFICATE OF SERVICE

The undersigned hereby certifies that a true and correct copy of **PLAINTIFFS' MOTION FOR RECONSIDERATION AND REVERSAL OF SUMMARY JUDGMENT UNDER FED.R.CIV.P.60(b)** has been served upon all counsel of record below, by CM/ECF filing, e-mail on February 9, 2017

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Hon.Richard A. Jones

UNITED STATES DISTRICT COURT
WESTERN DISTRICT OF WASHINGTON
AT SEATTLE

RICHARD J BAKER Plaintiff, v. MICROSOFT CORPORATION, et al., Defendant(s)	CASE NO. C16-396RAJ PLAINTIFFS' LEAVE TO FILE ADDITIONAL EVIDENCE IN REGARDS AUDIO-VISUAL TRANSCEIVERS NOTING DATE: 17th FEBRUARY, 2017

<u>PLAINTIFFS' LEAVE TO FILE ADDITIONAL EVIDENCE IN REGARDS AUDIO-VISUAL TRANSCIVERS</u>

The Plaintiff asks Leave of the Court to file additional factual evidence on a device supporting his argument that defendants accused systems infringe his issued US 5,486,001 patent claims working in same room, contrary to the Courts Summary Judgment findings Dkt 135 , dated 3rd January, 2017.

On 9th February 2017, Plaintiff Richard J Baker filed Dkt No 142 Motion for Reconsideration and Reversal Of Summary Judgment under Fed.R.Civ.P. 60 (b) New Evidence with Attachments: One of these attachments was Exhibit I, relating to Microsoft Patent US

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8,418,085 B2 "Gesture Coach" which plaintiff has said in earlier pleadings he believes reads on his earlier prior art US 5,486,001 ('001) and should not have been issued in 2013 by the USPTO. The main thing about this patent is that it shows the Court the inner workings of Microsoft peripheral device camera "Kinect" with associated Microsoft Xbox 360 console.

Plaintiff has shown with new evidence in Dkt #142 that by the defendants using a peripheral device camera in a first location and connecting this device via a network to remote computer at second location the defendants do infringe his approved '001 patent claims even working in same room but he also wishes to point out to the Honorable Court with additional evidence below how the defendants are actually also using similar means to his 1992 *audio-visual transceiver* mentioned in '001 patent specification and claims. Court had trouble, Page 9 lines 12-16 understanding how these two audio-visual transceivers could work in the same room and gave opinion, that helped formed basis of granting defendants Summary Judgment, plaintiff's '001 patent *remote database cannot be in same room as user whose motion is being captured via image capturing camera*, which is not correct, as plaintiff '001 patent only talks about in the specifications (a) sending informational data signals via audio-visual transceiver, communications means (a) from camera to computer and (b) out of computer/data base to users screen for viewing. In this way two audio-visual transceivers mentioned in '001 patent and user whose motion has just been captured via camera can be in the same room.

In Microsoft "Gesture Coach" Patent US 8,418,085 B2 patent, exhibit 1 see below at Page 17 Line 55 Microsoft uses plaintiffs transceiver type arrangement as USB powered up networking cable connection to Xbox 360 *system bus*. A System Bus is a single computer bus that connects the major components of a computer system, combining the functions of a data bus to carry information, an address bus to determine where it should be sent, and a control bus to determine its operation. On the return *informational data signal* journey Xbox 360 uses communications means Page 4 lines 27– 28 via, for example, an S-Video cable, a coaxial cable,

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an HDMI cable, a DVI cable, a VGA cable, or the like to display game or application visuals and/or audio to a user, Page 4, line 16. Ubisoft peripheral camera connected to the Nintendo Wii games console computer via USB networking works much the same. If these two accused systems are carrying out *data signal transmissions*, between hardware devices same as mentioned in plaintiff's '001 patent and approved claims, and considering the use of a peripheral device cameras puts the defendants devices in first and second locations mentioned in his '001 patent, computers in a *remote location* even in same room and the defendants are working plaintiffs inventive algorithm, finish up showing his personalised audio-visual instructional teaching presentation on a screen, everything mentioned and approved in his plaintiff '001 patent, plaintiff feels there is more than enough factual evidence he has presented for the Court to reverse Summary Judgment decision and send this case back for trial otherwise Court would cause grave injustice to the plaintiff.

Prayer

The Plaintiff hopes the Honorable Court will look on this additional evidence favourably and reverse Summary Judgment, send this case back for trial, for justice and consideration of court resources as well.

Respectfully submitted,

Dated: February 14, 2017 By: /s/ Richard J Baker

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CERTIFICATE OF SERVICE

The undersigned hereby certifies that a true and correct copy of **PLAINTIFFS LEAVE TO FILE ADDITIONAL EVIDENCE IN REGARDS AUDIO-VISUAL TRANSCEIVERS** has been served upon all counsel of record below, by CM/ECF filing, e-mail on February 14, 2017

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HONORABLE RICHARD A. JONES

UNITED STATES DISTRICT COURT
WESTERN DISTRICT OF WASHINGTON
AT SEATTLE

RICHARD J BAKER, Plaintiff, v. MICROSOFT CORPORATION, et al., Defendants.	CASE NO. C16-396 RAJ ORDER

This matter comes before the Court on Plaintiff's leave to file a motion for reconsideration outside the deadline. Dkt. # 136. Defendants oppose the motion. Dkt. # 139.

Plaintiff offers no justification for why he could not have discovered the allegedly "new material fact evidence" when the parties were arguing the motion for summary judgment. His motion suggests he only went searching for the new evidence once the Court rejected his arguments on summary judgment. Dkt. # 136 at p. 2. Furthermore, on February 1, 2017, Plaintiff filed his notice of appeal to the Ninth Circuit. Dkt. # 140. Plaintiff then filed his motion for reconsideration on February 9, 2017. Dkt. # 142. However, by filing an appeal with the Ninth Circuit prior to filing his motion for reconsideration, Plaintiff divested the Court of jurisdiction "over those aspects of the case involved in the appeal." *Stein v. Wood*, 127 F.3d 1187, 1189 (9th Cir. 1997).

Accordingly, the Court **DENIES** Plaintiff's motion. Dkt. # 136. This Order operates to terminate his pending motion for reconsideration and motion for leave to file additional evidence. Dkt. ## 142, 146.

Dated this 16th day of March, 2017.

Richard A Jones

The Honorable Richard A. Jones
United States District Judge

Hon.Richard A. Jones

UNITED STATES DISTRICT COURT
WESTERN DISTRICT OF WASHINGTON
AT SEATTLE

RICHARD J BAKER Plaintiff, v. MICROSOFT CORPORATION, et al., Defendant(s)	CASE NO. C16-396RAJ PLAINTIFFS' MOTION FOR INDICATIVE RULING Dkt # 142, 146 NOTING DATE: COURTS DETERMINATION

PLAINTIFFS' MOTION FOR INDICATIVE RULING DKT # 142, 146

On 9th February 2017 Plaintiff Richard J Baker submitted Dkt #142 Plaintiffs Motion for Reconsideration and Reversal of Summary Judgment under Fed,R.Civ.P.60 (b) New Evidence with exhibits and on 14th February 2017 submitted Dkt # 146 Plaintiffs Leave to file Additional Evidence in regards Audio-Visual transceivers. The trial court responded on 17th March 2017 with Order, Dkt #149 that because the Plaintiff filed a timely appeal the Plaintiff divested the Court of jurisdiction over those aspects of the case involved in the appeal. Accordingly, the Court Denies Plaintiff's motion Dkt #136. This Order operates to terminate his pending motion for reconsideration and motion for leave to file additional evidence. Dkt. #142, 146.

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The plaintiff files this motion under Fed. R. Civ. P. 62.1 Indicative Rule On A Motion For Relief That Is Barred By A Pending Appeal. If a timely motion is made

(a) for relief that the court lacks authority to grant because of an appeal that has been docketed and is pending, the court may:

(1) defer considering the motion;

(2) deny the motion; or

(3) state either that it would grant the motion if the supreme court remands for that purpose or that the motion raises a substantial issue.

b) Notice to the Supreme Court. The movant must promptly notify the supreme court clerk if the district court states that it would grant the motion or that the motion raises a substantial issue.

(c) Remand. The district court may decide the motion if the supreme court remands for that purpose.

The plaintiff herein asks the trial court for an indicative ruling as to whether it would entertain or grant the motions in Dkt 142, 146.

Prayer

The Plaintiff hopes the Honorable Court will look on this request favourably and advise whether it would entertain or grant the motions in Dkt 142, 146 via indicative ruling.

Respectfully submitted,

Dated: March 30, 2017 By: /s/ Richard J Baker

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CERTIFICATE OF SERVICE

The undersigned hereby certifies that a true and correct copy of **MOTION FOR INDICATIVE RULING DKT # 142, 146** has been served upon all counsel of record below, by CM/ECF filing, e-mail on March 30, 2017

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HONORABLE RICHARD A. JONES

UNITED STATES DISTRICT COURT
WESTERN DISTRICT OF WASHINGTON
AT SEATTLE

RICHARD J BAKER, Plaintiff, v. MICROSOFT CORPORATION, et al., Defendants.	CASE NO. C16-396 RAJ ORDER

This matter comes before the Court on Plaintiff's request for an indicative ruling on his untimely motion for reconsideration. Dkt. # 150. The Court **DENIES** the motion.

On January 3, 2017, the Court granted Defendants' motion for summary judgment. Dkt. # 135. According to Local Rule 7(h), Plaintiff then had fourteen days to seek reconsideration of this Order. W.D. Wash. Local Rules LCR 7(h)(2). On January 24, well outside the fourteen day deadline, Plaintiff requested leave to file his motion for reconsideration. Dkt. # 136. The Court denied this motion. Dkt. # 149. The Court gave two justifications for this denial: 1) Plaintiff did not carry his burden to show why he could not have discovered "new material fact evidence" in a timely manner, and 2) Plaintiff's appeal divested this Court of jurisdiction.

Plaintiff now requests that the Court rule on his untimely motion for reconsideration pursuant to Federal Rule of Civil Procedure 62.1. Dkt. # 150. Plaintiff is essentially seeking an end-run around his missed deadline. The Court did not deny his motion for leave solely because of the appeal, but also because the motion was meritless. The Court will not allow Plaintiff to circumvent this district's Local Rules. The Court denied his motion for leave to file an untimely motion for reconsideration (Dkt. ## 136, 149) and therefore cannot rule on the untimely motion for reconsideration (Dkt. # 142).

Accordingly, the Court **DENIES** Plaintiff's motion. Dkt. # 150.

Dated this 31st day of March, 2017.

The Honorable Richard A. Jones
United States District Judge

UNITED STATES DISTRICT COURT
WESTERN DISTRICT OF WASHINGTON

RICHARD J BAKER Plaintiff, v. MICROSOFT CORPORATION, et al., Defendant(s)	NOTICE OF CIVIL APPEAL Case No: C16-396RAJ District Court Judge The Honorable Richard A Jones

Notice is hereby given that Richard J Baker Appeals to the United States Court of Appeal for the Federal Circuit from Dkt No 151 a FRCP 62.1 motion regarding additional evidence contained in Dkt No 142 & 146. Entered in this action on 31st day of March, 2017

Dated: April 16, 2017

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RBaker

Signature of Appellant Pro Se

CERTIFICATE OF SERVICE

The undersigned hereby certifies I have served the **Notice of Appeal from Dkt No. 151** upon all counsel of record below, by CM/ECF filing, e-mail on April 16, 2017

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Baker

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[54] **PERSONALIZED INSTRUCTIONAL AID**

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[52] **U.S. Cl.** **273/183.1**; 273/186.1; 434/252

[58] **Field of Search** .... 273/35 R, 183.1, 273/185 A, 186.1; 434/247, 249, 252

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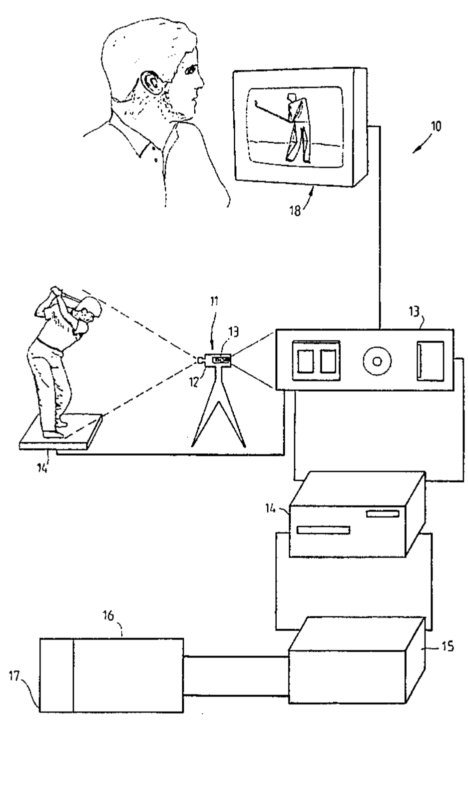
[57] **ABSTRACT**

An instructional aid (**10**) for enabling and assisting a person to emulate a predetermined movement such as a golf swing including an image/data capturing device (**11**) for scanning, capturing and storing the image/data signals of the person's golf swing or movement, and a transceiver (**14**) for transmitting the image/data signals over a communications network (**15**) to a remote computer (**17**). The computer (**16**) contains a database (**17**) which stores in digital form image signals and bio-mechanical data of a number of preselected swing or movements. The computer (**16**) analyzes the person's image/data signals against image/data of a preselected swing and generates in digital form further visual images/ data signals which can be transformed so as to assist or enable a person to be able to emulate the preferred swing. The instructional aid may also be used for analyzing or reporting on particular geographical regions or objects and provides a specialized presentation for development of that region or object from information stored in the computer database.

20 Claims, 2 Drawing Sheets



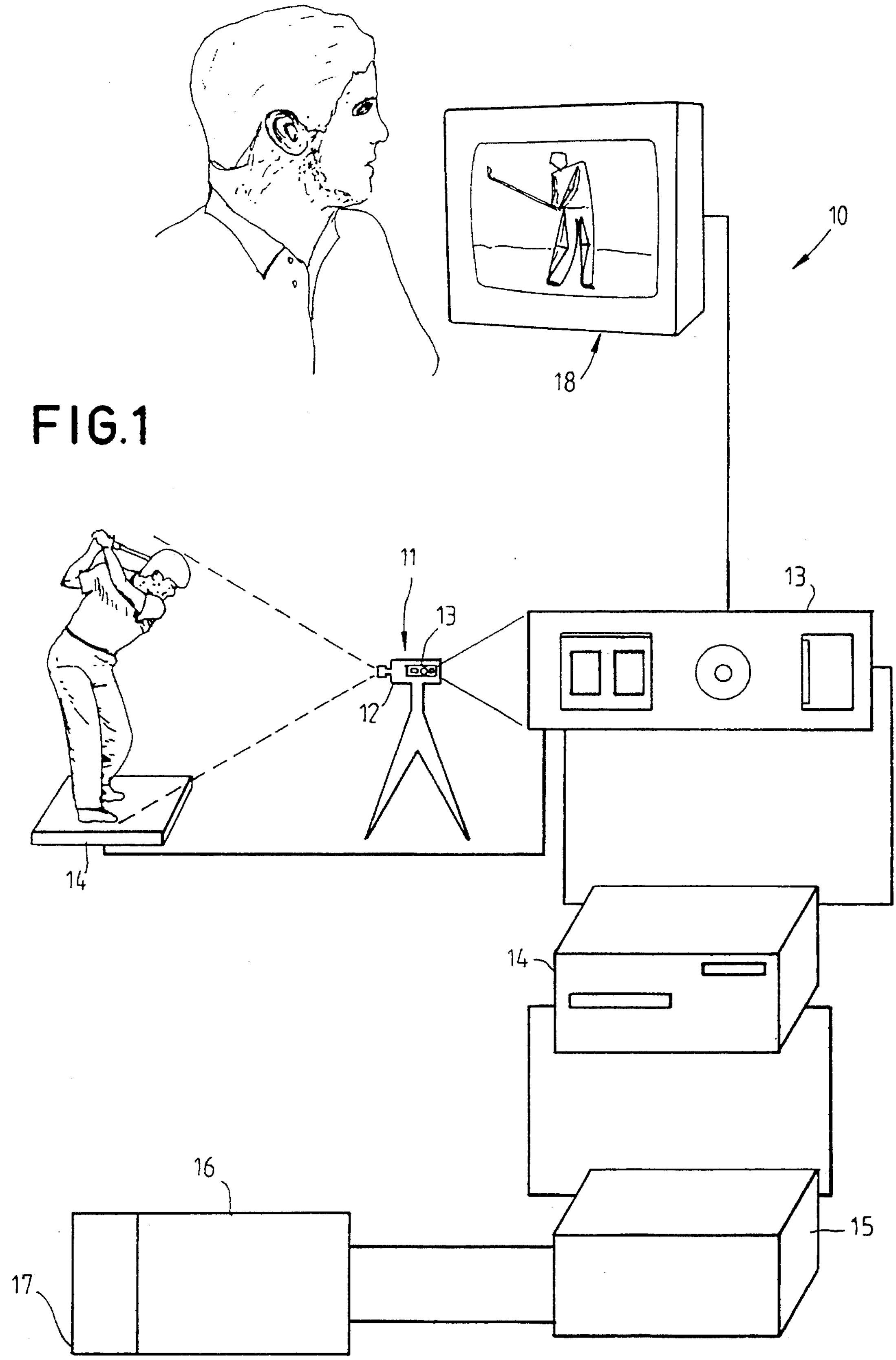


FIG.1

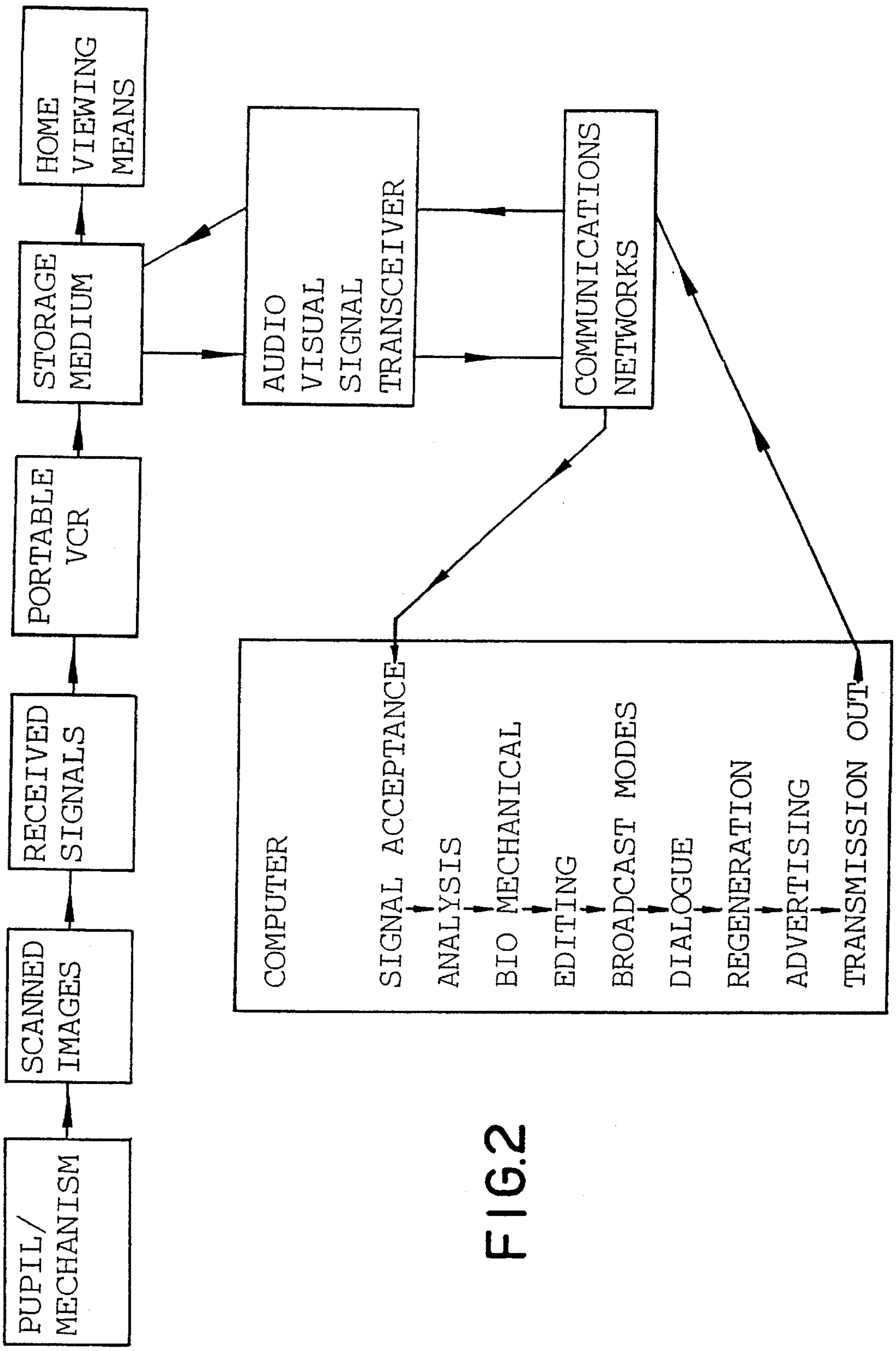

PUPIL/
MECHANISM
SCANNED
IMAGES
RECEIVED
SIGNALS
PORTABLE
VCR
STORAGE
MEDIUM
HOME
VIEWING
MEANS
AUDIO
VISUAL
SIGNAL
TRANSCEIVER
COMMUNICATIONS
NETWORKS
COMPUTER
SIGNAL ACCEPTANCE
ANALYSIS
BIO MECHANICAL
EDITING
BROADCAST MODES
DIALOGUE
REGENERATION
ADVERTISING
TRANSMISSION OUT

FIG.2

PERSONALIZED INSTRUCTIONAL AID

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to a method and apparatus means for providing an expert knowledge base in an instructional aid which in one aspect may be used as a teaching aid, and in particular as a teaching aid for teaching of movements and techniques, such as used in sports for the game of golf. The present invention, however, is applicable to other movements, sports, pastimes or techniques.

In a further aspect the present invention relates to a method and apparatus means for providing an expert visual or audio-visual assessment of a particular proposal relating to geographical locations. One such application is to generate a visual display of a particular tract of land for a golf course layout made up from a number of pre-stored hole designs or computer generated hole designs which have taken into account all aspects of the final layout design on the overall development, with the inclusion of audio or audio-visual data pertaining to structural methods for success.

The present invention has further application in providing an assessment on a particular object by, for example, comparing properties of that object with those of a preferred object.

2. Description of Background Art

As golf has become an increasingly popular pastime over the years, many players wishing to improve their own personal techniques, have pursued professional assistance. Often players, be they professionals or amateurs, may wish to emulate successful movements of top players or coaches who are exposed in the mass media. At the present time, these players have a number of choices available to them in attempting to try to emulate such movements, which may include either general practice, private coaching, viewing current audio-visual instruction tapes, recording their own personal movements and analyzing same, or studying photographs, slides, etc. of their swing in action.

In all the above cases, the onus is placed upon the individual or coach, to perceive those areas of movement that differ between the current technique of the player and that of the preferred technique they are trying to achieve. Even for a specialized person working in their own chosen sport or profession, such differences in movement can be so minute or hard to detect, for example, a person's weight shift or pressure in their grip or arms, that they can go undetected and so handicap that person's potential rate of improvement. The reason for this particularly in the above instructional visual teaching cases is that the viewer watches information flowing to him in one direction only regarding the current or preferred technique. Thus, the viewer cannot perceive all aspects of the movement because of no corresponding physical forces or certain performance data to relate specifically with. Such visual presentations do not show their current technique along with the preferred technique with the addition of bio-mechanical information. Also, in the use of current general prerecorded instructional audio visual presentations they direct their information towards a mass audience as a whole without any allowance for a person's particular technique or requirement of individual problem solving.

In other situations where conceptual instructional advice is required, the quality of advice can vary, for example, when a person is considering whether or how to best

construct a particular tract of land he owns or is considering acquiring. For example, for the development or remodelling of a golf course, normally expensive preliminary surveying, design and feasibility works are carried out, to which he is reliant on all aspects of the development being expertly covered, which is not always the case. Similarly, if alternative ventures in particular areas are proposed, no audio-visual means are presently available which provides a customized or personalized completely regenerated, expertly compiled computer analysis in the visual or audio-visual form of potential works.

SUMMARY OF THE INVENTION

The present invention aims to provide in one aspect an expertly analyzed instructional aid employing visual or audio-visual techniques which allows for a flow of information in both directions; for example, between selected coaches and pupils so as to help that pupil or viewer improve his or her personal movements and techniques more quickly and without as much guesswork on his or her part.

The present invention also provides a method and means for teaching or instructing such movements or techniques in precise ways, that enables a person or mechanism to more clearly emulate another movement. While the present invention is particularly suited in one application to sports coaching, it may also be applied to other areas where an emulation of a precise movement or procedure is required, as will become more apparent from the following operating description. The present invention may additionally be applied to providing expertly compiled opinion in the form of a visual or audio-visual overview of a particular geographical location altered in accordance with selected criteria.

With the above, and other objects in view, the present invention provides in a first preferred aspect, a method for providing an instructional aid for assisting a person to emulate a preferred movement including the steps of capturing and storing visual image signals representative of a particular movement, comparing said captured image signals with stored image signals representative of a selected preferred movement, and regenerating further visual image signals based on said image signals of said particular movement, adjusted to emulate said stored image signals of said selected movement.

In a second aspect, the present invention provides apparatus for providing an instructional aid for assisting a person personally to emulate a preferred movement or technique, said apparatus including means for capturing visual image signals of a particular movement or technique, means for storing said captured visual image signals, means for storing visual image signals of a plurality of preferred movements or techniques, means for comparing said captured visual image signals with the stored image signals of a selected said preferred movement or technique, and means for regenerating further visual image signals of said particular movement or technique adjusted in accordance with said selected preferred movement or technique to assist a person to emulate said selected preferred movement or technique. The term "image signals" as used herein includes signals representative of such images such as digital information which can be converted into visual images.

Preferably the visual images of the particular movement are captured and stored in digital form using known video recording techniques such as with a video camera which produces a video cassette containing the images of said particular movement. Alternatively, other means may be provided for capturing and storing the visual images as described further below. The visual images of the preferred movements are preferably stored in digital form in a data base of a computer so that a selected preferred movement can be readily accessed. The computer is most preferably located at a remote location so as to be accessible from a number of different locations.

Preferably means are provided to transmit the captured images in digital form for receipt by the computer. The transmitting means preferably transmits the images over the normal telephone network; however, other communications links may be employed.

The comparison in the computer can be carried out using either software techniques or hardware techniques and various sampling procedures. The computer is also preferably software or hardware programmed to take into account the size of the player and other physical characteristics such as length of arm so that a compensation factor may be included, whereby the movements such as swings of the player and the preprogrammed stored movements or swings in the computer can be truly compared. This comparison can take place at different times or positions in, for example, a swing to produce signals representative of the differences between the swings. This comparison signal may comprise a measurement of distance, angle, speed of swing or other parameters. Such signals may then be employed in regenerating the new visual image which approximates the captured image altered to emulate the preferred image.

While the invention described within has particular applications to teachings in sport, so as to help and assist a person emulate a particular movement or technique, it may also be applied to many other situations and fields where an emulation or overview of a precise movement is required. Thus, the invention may be applied to various applications in the art fields, for example, the teaching of dance steps or within the medical field where precise movements are required to be studied, and expert advice given such as with human body movements.

Additionally, the present invention may be applied to fields where expert systems appraisals and emulations of a development structure may be required such as in the property field for precise calculations and designs of future development proposals or where expert appraisal of a particular object is required by comparison with a preferred or ideal object.

The present invention thus provides in a further aspect a method of providing an instructional aid relating to a development proposal comprising the steps of capturing and storing visual image and location data signals of a proposed development location, analyzing said captured signals against the signals of a selected or preferred known development or means for forming a new design development, and regenerating further visual image and data signals based on said signals of said proposed development adjusted in accordance with said preferred development or said newly formed design development so as to provide a recommendation for said preferred development.

In a further aspect, the present invention provides apparatus for providing an instructional aid based on a visual image of a particular movement or location, said apparatus including means for visually scanning said movement or location and for producing visual image signals representative of said movement or location, means for storing said visual image signals, means for transmitting said visual image signals to a remote location, means for comparing said transmitted visual image signals with corresponding signals of a selected pre-stored image or images, means for regenerating further image signals comprising said image signals of said particular movement or location adjusted in accordance with said pre-stored signals of said image or images, and means for retransmitting said regenerated image signals and converting said image signals into a format which enables viewing thereof.

In yet a further aspect, the present invention provides apparatus for providing a personalized instructional aid in a development presentation based upon a visual image signal of a particular location, said apparatus including means for visually scanning said location and for producing image and informational data signals representative of said location, means for storing said visual and data signals, means for transmitting said visual and data signals to a remote location, means for comparing said visual and data signals with the signals of a selected pre-stored location and the structural procedure relating thereto visual and data signals, means for regenerating further visual and data signals based on said signals of said particular location adjusted in accordance with said pre-stored procedure signals to assist in said development, means for adding dialogue and information data to said regenerated signals, and means for transmitting said regenerated image and data signals and converting said signals into a format which enables viewing thereof.

In another aspect, the present invention provides apparatus for providing a personalized instructional aid based upon optical photometric characteristics of a selected target, said apparatus including means for visually scanning, sensing and capturing visual and data signals representative of said target, means for storing said visual and data signals, means for transmitting said visual and data signals to a remote location, means for comparing said visual and data signals with corresponding pre-stored signals of a selected target, means for regenerating further visual data signals comprising said signals of said particular target adjusted in accordance with said pre-stored preferred target signals, means for transmitting said regenerated image and data signals and converting said image signals into a format which enables viewing thereof.

Preferably the characteristics of the target which, for example, may be an object are sensed using imaging and non-imaging sensor systems. Preferably, also means are provided for adding dialogue or informational data to the regenerated format.

BRIEF DESCRIPTION OF THE DRAWINGS

Reference will now be made to the accompanying drawings which illustrate a preferred embodiment of the invention and wherein:

FIG. **1** illustrates in block diagram the instructional aid according to the present invention applied to the game of golf; and

FIG. **2** is a flow chart showing the procedure involved in the invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

FIG. **1** illustrates the apparatus for use in the present invention described below in reference to emulation of a golf swing, but usable in any situation where emulation of movement is required. The apparatus **10** includes a visual image capturing device **11** which is adapted to capture movement of the person undertaking a golf swing for subsequent analysis and correction as described below with reference to FIG. 1 and the flow chart of FIG. 2.

To capture the initial detailed visual images relating to physical characteristics including movement techniques employed during the golf swing, various scanning or electronic collecting procedures are used. For this purpose the image capturing device **11** preferably incorporates a portable electronic camera such as a video camera **12** or the like having an associated recording or signal storage means **13** as is known in the art to form and store signals representative of the characteristics of movements, etc. being viewed.

Where recording of movements takes place, bio-information data, may also be transmitted or collected upon the same storage means **13** contained within the framework of the portable video camera **12**, so as to enhance further final specialized teaching or information features. Such bio-mechanical information data may be transmitted to the recording or storage means **13** by an electronic means, hard wiring or other communication means, either at the same time, as the captured visual signals relating to scanned images of the person being viewed or at a different time. In the embodiment illustrated, bio-mechanical information may be captured using a weight sensing pad or pads **14** which will sense weight transference during the swing.

The means used to collect and transmit such bio-mechanical information data, is at all times non- restrictive in its overall performance, so as to allow the pupil being analyzed to achieve normal free flowing movement without restriction. One such means may take the form of mechanical devices affixed or attached, to the person or golf club moved by the person so as to show data such as pressures transferred through the arms or hands, proper releasing techniques, velocities achieved, etc. Alternatively or additionally, sensing devices may be positioned alongside, below or above the person whose image is being captured. Such sensing devices as above may comprise weight or load sensitive pads, monitors, electronic light beaming devices or the like. Bio-mechanical, signals may also be obtained by various scanning, editing and digital techniques, used within a remote computer data base as described further below, once the signal has been received by the remote data base, to determine also the many characteristics of the person being studied.

The image capturing device **11** is preferably of portable construction, and of high recording quality, so as to scan, receive and store images and information data in broadcast quality. These visual or information signals are converted by sensors or the like into electrical charge patterns, etc., which are read out or scanned to produce digital electronic signals representative thereof, from electrical or light signals, produced by an electronic pick-up tube, charge-coupled device (CCD), or the like means within the camera framework, or by the information signalling devices referred to above.

For initially capturing the necessary signals for analysis, more than one image capturing device **11** may be used, so as to channel information regarding various visual details, information and data or the like, to one recording or storage medium. In this regard various switching techniques may also be used to switch between selected image capturing devices **11**.

The signal storage or recording means may take the form of magnetic tape or disk, laser based or optical video disk, magneto-optic disk, magnetic-laser-optical disk or other storage medium. Alternatively, digitized signals representative of the scanned images or bio-mechanical and information data may be also transferred or stored onto a computer memory chip or the like, held within the camera framework.

The apparatus **10** also includes an audio-visual signal transceiver **14** adapted to receive and transmit audio-visual signals and other information signals in the manner described below.

The image capturing device **11** referred to above in one form is a unit discrete from the audio-visual signal transceiver **14** and adapted to be connected thereto or the two may be one and the same, so that the image capturing device **11** also incorporates a unit for transmission and reception of signals to and from remote data bases.

The audio-visual signal transceiver **14** may take the form of a portable signal unit or a personal computer (PC), which can convert, compress or suitably accept, a down-loading of captured signals, stored within the storage means **13** of the portable camera unit and then reform, record or store such signals in a suitable digital state for later transmission over a communications network **15**. The communication network **15** may comprise the general switched telephone network, satellite links, television quality cable links or the like over which the signals representative of the person's movement together with bio-mechanical information where stored are directed as electrical or light signals to a remote computer **16** for storage in a computer data base **17** for later analysis against selected preferred signals also stored in a database of the computer or a another computer. As is conventional a modem or other similar signal conversion device may be associated with the computer **16** to receive the transmitter signals and convert those signals into a suitable form for reading by the computer **16**. The modem or other similar signal conversion device may also be employed for transmission of signals from the computer **16** as described further below.

Initial capturing of audio, visual and data signal information, may also be undertaken using the audio-visual signal transceiver **14** (if not a personal computer) to which a video camera **12** may be directly connected so as to enable signals captured by the camera **12** to be recorded directly onto suitable storage medium held within the transceiver **14**. The transceiver **14** is then able to transmit these captured signals to remote locations, when directly connected to the communications network described above. Thus, a single unit may perform all functions of recording, transmitting and receiving audio, visual and data signal information. The transceiver **14** for this purpose may include dual signal storage facilities, to achieve the above functions; however, the transceiver **14** may also be constructed so as to enable all functions of recording and playback in each mode within a single signal storage device.

This transceiver **14** is software and hardware programmed and may offer some of the following features:

1) The sender's details for later personalizing effects to the final video presentation, i.e., name and spoken language and means for selecting the person with whom the golf swing of the person is to be compared;

2) The transmitting party's or agent's details for account keeping purposes and security for the system, i.e., digitized security code;

3) Circuitry for increased transmission speed;

4) Circuitry and displays for showing details regarding signalling times to reach data base and regeneration times once retransmitted back to pupil's or agent's remote location, for account keeping purposes;

5) Circuitry and displays for showing the format of transmitted or requested signals in PAL, NTSC or SECAM, etc.;

6) Circuitry for time, date, automatic dial–redial, stop, start, receive, send, and possibly an advertising channel, etc.; and

7) Circuitry and displays for showing to whom the regenerated signals belong and to enable the retransmitted regenerated signal to be added to the already prerecorded signal, described below, if desired.

As stated above, the computer **16** is arranged normally at a remote location from the audio-visual transceiver **14** and includes a data base **17** which stores selected prerecorded video signals in digital form which in the case of golf swings may include a selection of swings showing the movement of different golf professionals which are required to be emulated. As the computer **16** and image capturing device **11** are not physically affixed or attached together, the computer **16** and data base **17** may be of a sufficient size and capacity to enable the desired functions to be achieved at one and the same location.

The computer **16** may be at many remote locations and holds within its database the following prerecorded information in digital form, which provide a basis for forming the regenerated audio-visual signals.

1) A digitized audio visual library of selected coaches, advisers, professional or mechanism (such as a golf simulation machine) movements, techniques, steps or procedures, that have been previously analyzed, recorded and reformed into suitable digitized signals, for later analysis and regeneration in the data base against the remote signals received.

2) A digitized bio-mechanical library of selected coaches or mechanism movements measured individually or as a group, for later display with the regenerated audio-visual signals.

The computer **16** incorporates a means for receiving and editing the transmitted visual data or bio-mechanical and information data signals, relating to the movement of the golfer, and arranges same in such a way as to be able to match the received visual signals with the previously established and selected data base signals of their preferred applications and generate a new video signal to enable the Viewer to see personally, in regenerated form, those differences that exist in: (a) a teaching mode, between the two movements, that of the pupil and the selected professional or coach; and (b) in an analysis mode, those ideas that might be possible for their preferred swings (or applications in development fields where the method and apparatus of the invention is used in this application). For this purpose, the computer is software and/or hardware programmed to compare the respective swings of the person being analyzed and the selected preferred swing with adjustments made such as for size of person, speed of swing and other parameters to allow a correct comparison. The differences between the swings are measured by sampling or other techniques and this difference added or subtracted from a person's recorded swing and new visual images generated on this basis which emulates the preferred movements.

The computer **16** may also include a means for adding dialogue to the regenerated audio visual signal recordings, so that the viewer can receive personalized instruction or advice from afar, similar to having private instruction or personal consultation.

The computer **16** may further include a means for converting received signals, if needed, in one broadcasting mode, into those of another countries, e.g., PAL, NTSC, SECAM, etc.. To accomplish this within the computer, a standards converter or the like may be used, using an optical scan or a digital standard features or the like.

The computer **16** may additionally include a means for determining the cost of each and every received and regenerated signal that passes through the system, based upon the following information:

(a) Signal transmission time to and from the computer.

(b) The amount of analysis and regeneration time required for each and every presentation, such as with the showing of audio-visual faults, bio-mechanical and characterized data graphs, dialogue, and broadcasting changes, etc..

The computer **16** is software and hardware programmed, to accept digitized signals transmitted to it, from remote locations, associated with the audio-visual transceiver **14**, so as to personally relate in the final regeneration and editing phases to the viewer; this being performed by, using various digital editing techniques and procedures as described below.

The audio-visual presentation generated by the computer **16** can take the form of split-screening (generating new visual images of the preferred technique displayed alongside the present technique), superimposing (where the preferred technique is superimposed over the present technique) or other displays, graphics, charts, etc. for bio-mechanical and information displays, so that the viewer can clearly see those changes that are required or need to be performed, to develop or pursue the preferred movement, procedure or proposal. These superimposing effects or the like, may take the form of stick figures, detailed drawings, etc. of normal human or visual appearances, so as to show the viewer any variances between his stroke and the preferred stroke. For ease of editing the subject material within this computer data base, a time code or the like, maybe also burned into the original recorded signal, so as to make final editing much more efficient within the remote data base. This procedure may also be linked with an edit controller or the like, within the computer **16**, which locks the two signals electronically together during editing.

To personalize the regenerated signal, dialogue is also added when required, so that the selected instructor or adviser may relate to the viewer or pupil more personally, than with other audio-visual presentations. Part of this personalizing effect is initially accomplished in the original transmission phase, by the name, spoken language, broadcasting mode or location statistics, etc. of the final viewer being captured within this data base to which an addition of dialogue can also be added when required in the regeneration signal phase, and showing those changes they need to perform or consider to obtain the preferred movement; thus, totally personalizing the new regenerated signal to the viewer.

For this purpose such dialogue, may only take the form of a brief statement, so as to make the viewer fully aware of those changes that are required, or need their consideration, to perfect the movement, procedure or development, etc..

The means for adding such dialogue may take the form of a voice energy monitor or the like, contained within the computer, which on analysis scans a memory bank of learned words or phrases to find suitable terms, to bring attention to these problem areas or matters needing their attention.

Dialogue may also be added relating to recommendations for the viewer's consideration in regards to suitability of equipment being used to perform the desired movements and techniques.

To increase acceptance as a true teaching aid, scientific data, which in many applications could only be assumed before, such as with personalized coaching, may be presented to a viewer, when needed, in the form of graphs, charts or the like, set either above, below, alongside or within the total regenerated video signal recording. This information is gathered from their received signals, being matched to their preferred established signals contained within the data base **17**, so that the person or pupil can clearly see, those bio-mechanical differences that exist between, their current procedures or techniques and that of their selected coaches or professional's procedures or techniques.

Once the new audio-visual signal is regenerated, the signal is then retransmitted back by the computer **16** and via a modem or the like and the communications network **15** to the remote sender's or agent's transceiver **14**. This procedure may be performed, from within the computer **16** itself, using various digital, compression and sampling techniques, or it can be again sent back by a further audio-visual transceiver associated with the computer **16**.

On receipt at the remote pupil's or agent's receiving location, the regenerated signal may already be in suitable form, for direct saving on suitable storage means such as video tape, disk or the like which enables home viewing such as by means for a video cassette player and playback through a monitor **18**. If not in a suitable form for direct saving, the signal may be reformed for storage as above on storage means which permits home viewing other than through a computer monitor by the use of either the receiving audio-visual transceiver, or by other suitable conventional means, offering various slowing down or speeding up signal procedures. If desired the regenerated audio-visual signal may be stored on the original storage means, e.g., video tape containing the player's current movements or techniques, or stored on a new storage means.

In the embodiment described and shown, the image capturing device **11** stores the captured images on a video cassette **19** of known form and the regenerated images are stored on the same cassette **19** or, alternatively, an additional cassette. The regenerated image in this embodiment is in the form of a stick FIG. **20** which is superimposed on the true visual image **21** (see FIG. **1**) of the player's swing or movement, and which indicates to the player the angles and positions which he must adopt to emulate the swing.

To add further to this advanced audio-visual teaching aids' value, as a complete instructional system, compared to other audio-visual presentations, previously recorded instructional material, of a non-personalized nature, may also be added, to the final home storage presentation means such as a video cassette. Thus, this regenerated transmitted signal of the pupil's audio-visual presentation and data pertaining to movements, may be then simply added to the prerecorded material already held at the sender's or agent's remote location. In this format the single recording may then show: (a) an initial complete recorded procedure of instruction, as currently presented with audio-visual presentations; (b) an addition of their current movements, procedures or images etc. taken before regeneration; and (c) the final regenerated personalized audio-visual changes, that are required or affect the desired changes needed by the viewer.

A typical presentation with a preferred format and structure in the final video tape or other viewable means could be as follows:

Pupil: Mr. Rick Baker
Selected coach: Mr. Bobby Jones
Application for: Golf
Dialogue: English

1. Preferred audio-visual introduction:

"Hi, Rick, I am Bobby Jones. It is my pleasure to have studied your golf swing, and these are the points I feel you should be concentrating on."

2. Preferred audio-visual presentation in progress:

During the presentation while the pupil, Mr. Baker, is viewing the subject matter, the viewing monitor is showing segments of the previously recorded swing, taken at the recording facility, with superimposed preferred movements of Mr. Jones against Mr. Baker's current movements and pointing out with the addition of dialogue, those areas that he should be concentrating on, so as to improve his current technique. Bio-mechanical data in the form of graphs or charts, etc., are also added during the presentation, so that he and his local coach may also quite clearly see scientific data pertaining to those performed movements. Dialogue may also be added regarding suitability of equipment being used at this stage.

3. Towards the conclusion of this audio visual presentation, the coach could conclude by saying: "Thank you Rick for allowing me to help you improve your game, but please continue to work on these points with the help of your local professional, who is also there to assist you in overcoming these problems. Good golfing, this is Bobby Jones."

The above embodiment has been described with reference to a golf swing movement; however, as previously stated, the invention may readily be applied where other movements are required to be emulated. Such movement may comprise either movements of persons, movements of objects or mechanisms of which emulation is required.

In a further form the invention may be applied to the property field to enable professional assessments and presentations of designs for future development proposals or the like. In this form visual images and data relating to signals of a particular area of ground are captured using remote sensing techniques. For this purpose a camera and a remote sensing device may be fixed to the underside of an aircraft so as to capture and record geometrical or statistical information of the earth or objects featured beneath. Geographical data achieved through using this remote sensing as above may be computer coded or digitized using either video cameras, array scanners, laser beam, microwave or other means.

Information regarding the geographical area being scanned is then transmitted as before using a transceiver to a remote computer containing a data base of pre-stored expert information on attributes required of a particular area of land. Thus, where the best standard of golf course is required to be laid out upon a specific parcel of land, the data base may include a library of selected hole layouts from different courses. The computer which is software programmed may then select preferred hole layouts to match to the area of land of which geographical features has been scanned and recorded. Alternatively, the computer may itself design the appropriate hole layouts to best fit the area of land and proposed development. The computer data base may additionally include feasibility study means for determining and displaying measurements, costs and other procedures required to achieve the end result. The computer may further be programmed to take into account residential housing around the course and the location of same, so as to maximize the view of the course, etc..

As before, dialogue may be added to the regenerated audio-visual presentation as well as statistical graphs or other information relating to the development being studied.

The present invention may also be applied to enable a particular object to be analyzed against pre-stored data relating to a currently known object. In this embodiment and as before an object is scanned so that its characteristics may be determined. Scanning is carried out to obtain the optical photometric characteristics of the object using imaging and non-imaging sensor systems. As before the data obtained is stored and then transmitted to a remote location for analysis in a computer with the corresponding data of a preferred object whose data information is captured in a data base. After comparison and adding, where appropriate, suitable dialogue from an expert in that field, a regenerated signal is formed and transmitted back to the sender so that the sender has an expert assessment of the differences between the respective objects. A particular application in this embodiment is for component parts used in an assembly. The data information obtained relating to that part may be compared to a perfect component part whose data is stored at the remote location so that the differences may be assessed. This embodiment may also be employed for detecting, for example, faults in a particular component part.

It will be apparent that the latter embodiment may be applied to any suitable target of which analysis is required. The present invention, thus, provides a method and means for expertly teaching or instructing procedures, strategies, assessments or perceptions in audio-visual form to enable a viewer to more closely emulate, calculate or develop techniques suitable to their various applications.

While the above has been given by way of illustrative embodiments of the invention, all such modifications and variations thereto as would be apparent to persons skilled in the art are deemed to fall within the broad scope and ambit of the invention as herein defined by the appended claims.

I claim:

1. A method for providing an instructional aid for assisting a person to emulate a preferred movement, said method comprising:

capturing and storing initial visual image signals representative of a particular movement at a first location,

storing preferred image signals representative of a selected preferred movement at a second location remote from said first location in a data base of a computer,

transmitting said captured and stored visual image signals from said first location to said computer at said second location,

comparing said captured and stored image signals with stored preferred image signals in said data base of said computer,

regenerating further visual secondary image signals based on said initial image signals of said particular movement adjusted to emulate said stored preferred image signals of said selected movement in said computer, and

transmitting said regenerated signals from said computer at said remote second location to said first location and stored in image presentation means which permits viewing thereof with dialogue relating to said regenerated visual secondary image signals.

2. A method according to claim **1**, wherein said initial visual image signals of said particular movement are captured and stored using a video camera.

3. A method according to claim **1** wherein said transmitting comprises selecting an independent signal transmitter or a personal computer.

4. A method according to claim **1** wherein said transmitter transmits said image signals over a communication network to said computer.

5. A method according to claim **1** wherein bio-mechanical data relating to said regenerated images is displayed within an image presentation.

6. A method of providing an instructional aid relating to a location development recommendation, said method comprising the steps of:

capturing and storing initial visual image and location data signals of a proposed development proposal at a first location and transmitted to a second location remote from said first location,

analyzing at said second location said initially captured signals against the stored visual image and location data signals of selectively one of a preferred known location development and a new design development stored in a data base of a computer,

regenerating further secondary visual image and location data signals based on said initial signals of said proposed development adjusted in accordance with said visual image and data signals of selectively one of said preferred known location development and said new design development in said stored data base of said computer so as to provide a location development recommendation for said preferred development, and

transmitting said location development recommendation from said computer back to said first location for analysis.

7. A method according to claim **6**, wherein said visual image and data signals of said proposed development are captured and stored using a device selected from a video camera and a remote sensing device.

8. A method according to claim **6**, wherein said transmitted regenerated image and data signals are provided in a format for subsequent home viewing.

9. A method according to claim **8**, comprises the addition of dialogue to said format so as to provide an audio-visual presentation.

10. Apparatus for providing an instructional aid for emulation of a preferred movement, said apparatus comprising;

means for capturing visual image signals of a particular movement at a first location,

means for storing said captured visual image signals at a second location remote from said first location,

means for storing visual image signals of a plurality of preferred movements at said second location,

means for comparing said captured visual image signals with the stored image signals of a selected one of said preferred movement at said second location, and

means for regenerating further visual image signals of said particular movement adjusted in accordance with said selected preferred movement to instruct in emulating said selected preferred movement at said first location.

11. Apparatus according to claim **10**, wherein said means for storing visual image signals of a plurality of referred movements comprises a computer data base and wherein said comparing and regenerating means comprises a computer associated with said computer data base.

12. Apparatus according to claim **11** comprising a transceiver means for transmitting to said computer said visual image signals of said particular movement and for receiving from said computer said regenerated visual images signals.

13. Apparatus according to claim **11**, comprising means for converting said regenerated image signals into a format which allows viewing thereof.

14. Apparatus according to claim **13**, comprising means for adding to said format dialogue relating to said regenerated images.

15. Apparatus according to claim **13**, comprising means for adding to said format bio-mechanical data relating to said regenerated images.

16. Apparatus for providing an instructional aid based on a visual image of a particular location comprising:

means for visually scanning said location and for producing visual image signals representative of said location,

means for storing said visual image signals,

means for transmitting said visual image signals to a remote location,

means for comparing said transmitted visual image signals with corresponding signals of a selected prestored image,

means for regenerating further image signals comprising said image signals of said particular location adjusted in accordance with said selected pre-stored signals of said image,

means for retransmitting said regenerated image signals,

and converting said image signals into a format which enables viewing of said regenerated image signals of said particular location at said means for visually scanning the instructional aid.

17. Apparatus for providing a personalized instructional aid in a development presentation based upon a visual image signal of a particular location comprising:

means for visually scanning a particular location and for producing image and informational data signals representative of said particular location,

means for storing said representative visual and informational data signals,

means for transmitting said representative visual and informational data signals to a remote location,

means at said remote location for comparing said representative visual and informational data signals with the signals of a selected pre-stored location and a structural procedure related to visual and informational data signals,

means at said remote location for regenerating further visual data and informational signals based on said signals of said particular location adjusted in accordance with said pre-stored procedure signals to assist in said development,

means at said remote location for adding dialogue and informational data to said regenerated signals,

means for transmitting said regenerated image and informational data signals from said remote location, and

converting said regenerated image and informational signals into a format which enables viewing to provide a personalized and instructional development presentation.

18. Apparatus for providing a personalized instructional aid based upon optical photometric characteristics of a particular target comprising:

means for visually scanning, sensing and capturing visual and informational data signals representative of a particular target,

means for storing said representative visual and informational data signals,

means for transmitting said representative visual and informational data signals to a remote location,

means for comparing said representative visual and informational data signals with corresponding pre-stored signals of a selected target,

means for regenerating further visual and informational data signals comprising said signals of said particular target adjusted in accordance with said pre-stored selected target signals,

means for transmitting said further regenerated visual and informational data signals, and

converting said further regenerated visual and informational data signals into a format which enables viewing to provide a personalized instructional aid.

19. Apparatus according to claim **18**, wherein said regenerated format comprises further means for adding selectively one of dialogue and informational data to said regenerated format.

20. Apparatus according to claim **18**, wherein said target scanning means comprises selectively one of an imaging sensor system and a non-imaging sensor system.

* * * * *

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(54) **GESTURE COACH**

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(57) **ABSTRACT**

A capture device may capture a user's motion and a display device may display a model that maps to the user's motion, including gestures that are applicable for control. A user may be unfamiliar with a system that maps the user's motions or not know what gestures are applicable for an executing application. A user may not understand or know how to perform gestures that are applicable for the executing application. User motion data and/or outputs of filters corresponding to gestures may be analyzed to determine those cases where assistance to the user on performing the gesture is appropriate.

19 Claims, 17 Drawing Sheets

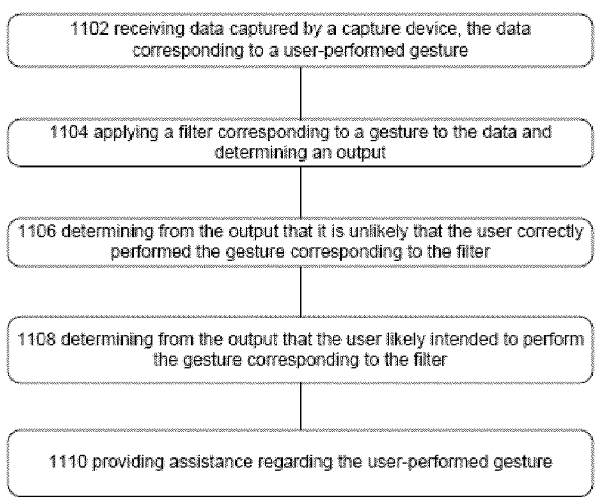

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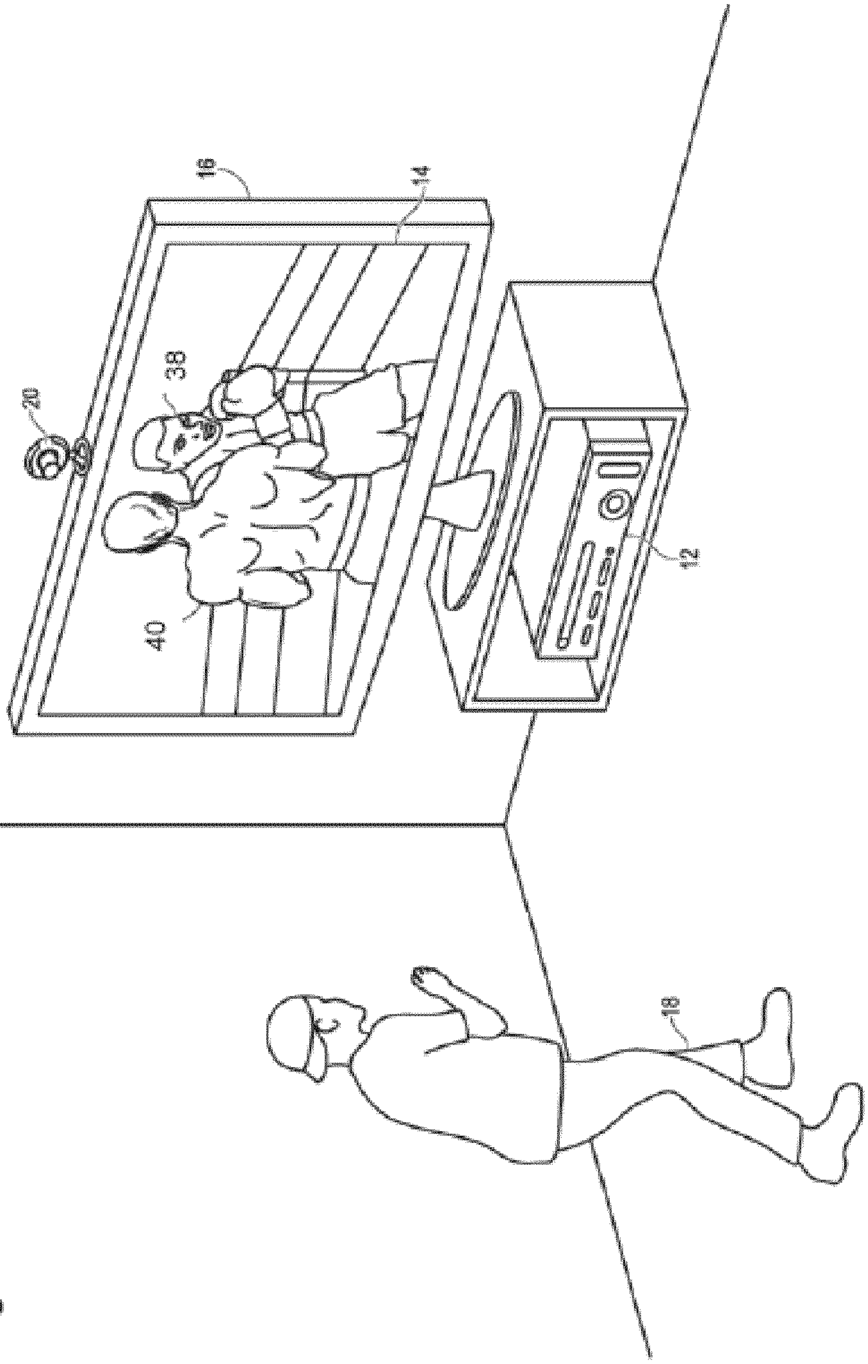
Fig. 1A



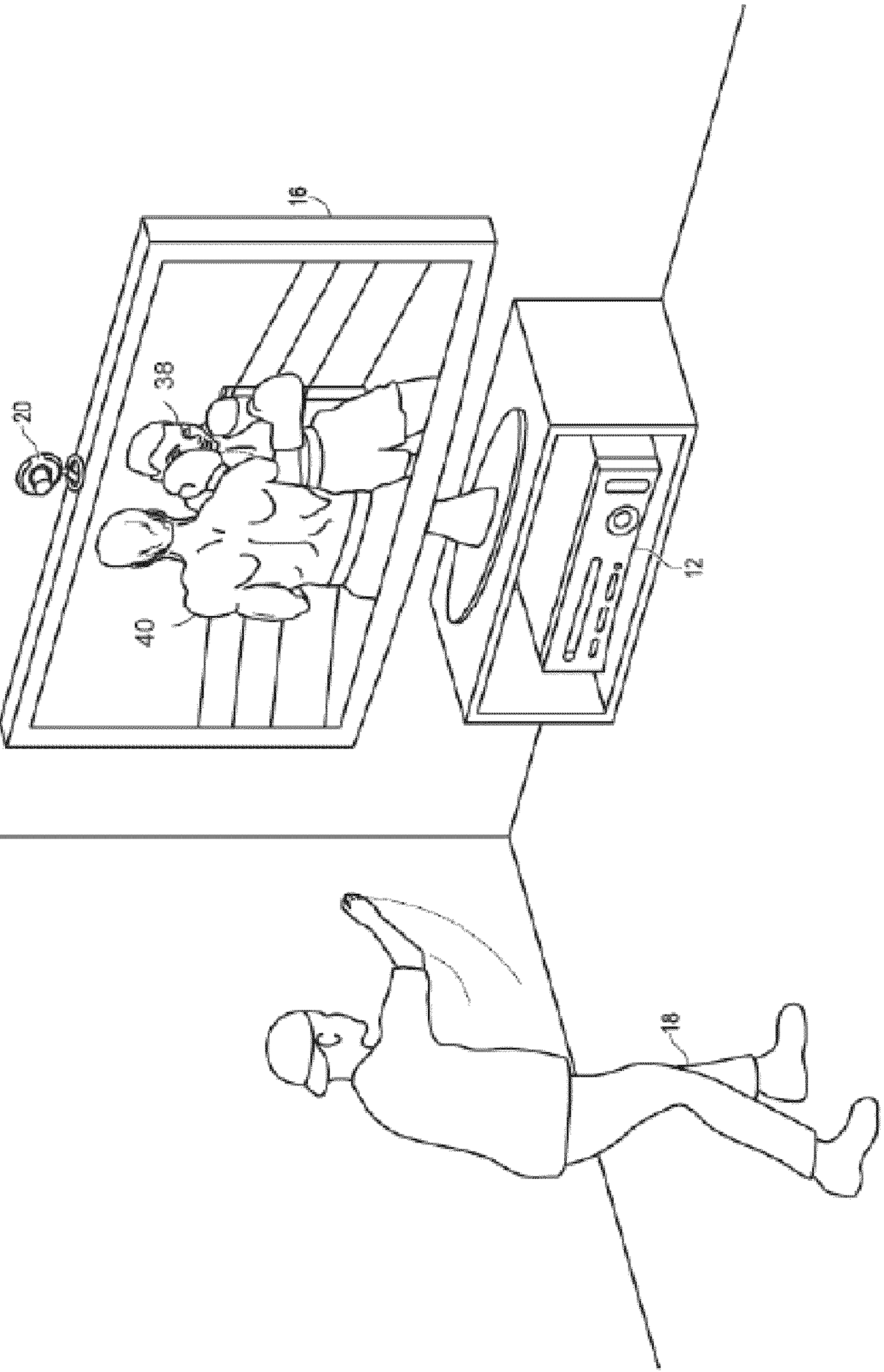
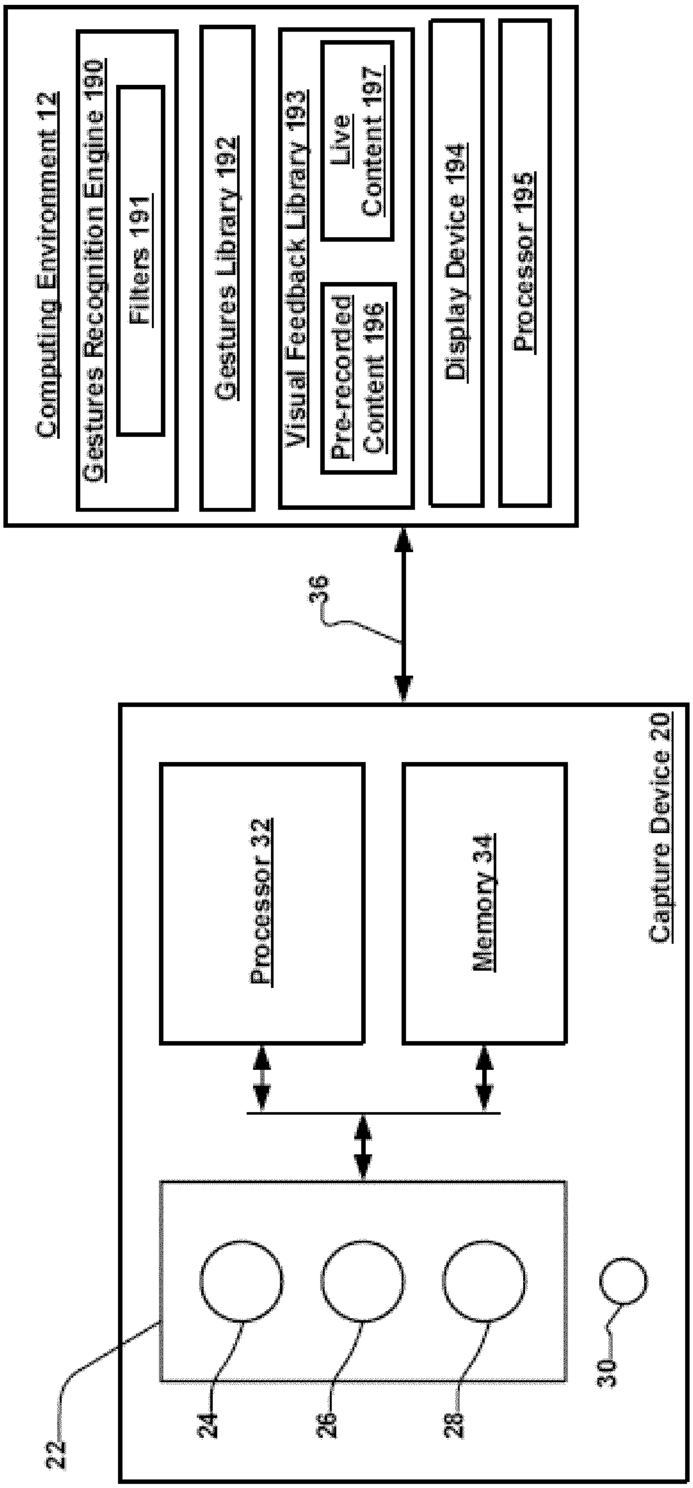


Fig. 1B



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Processor 32
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Capture Device 20
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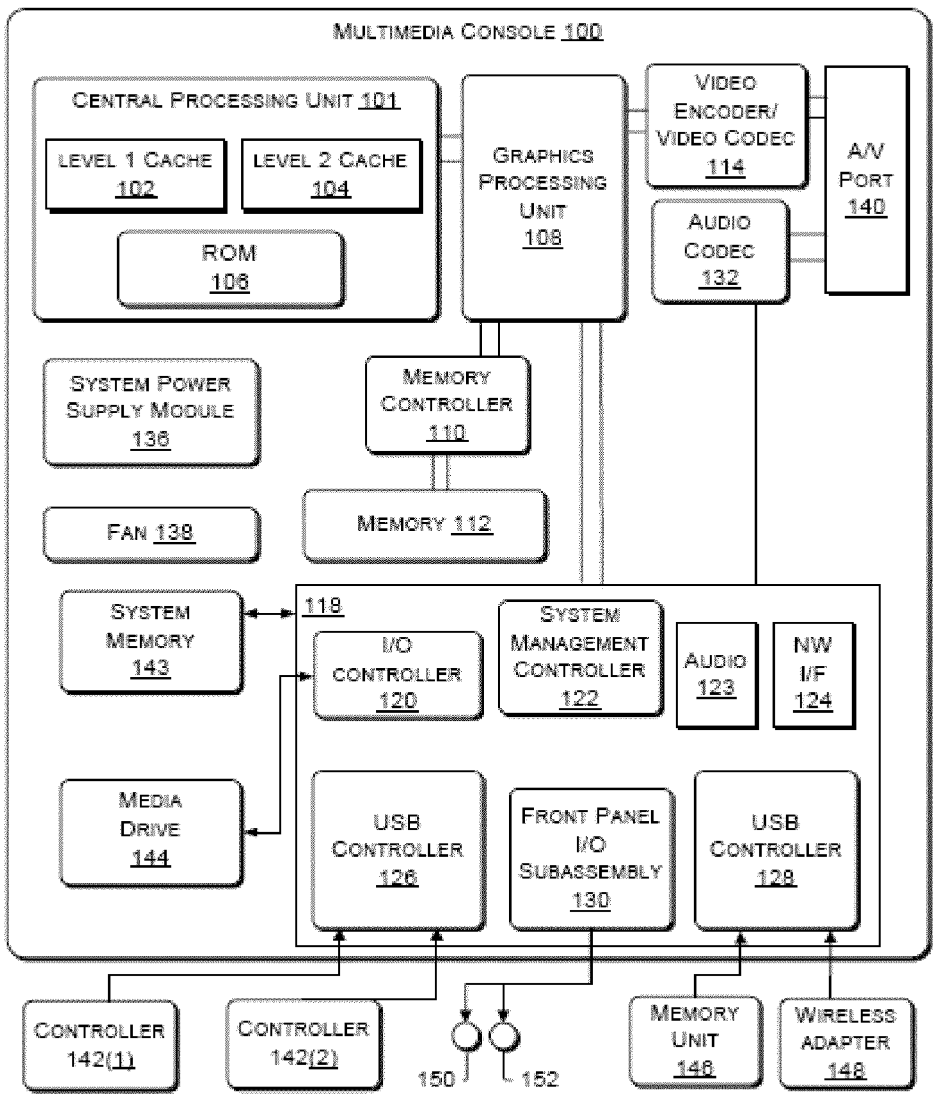
28
30

FIG. 2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USB CONTROLLER 128
CONTROLLER 142(1)
CONTROLLER 142(2)
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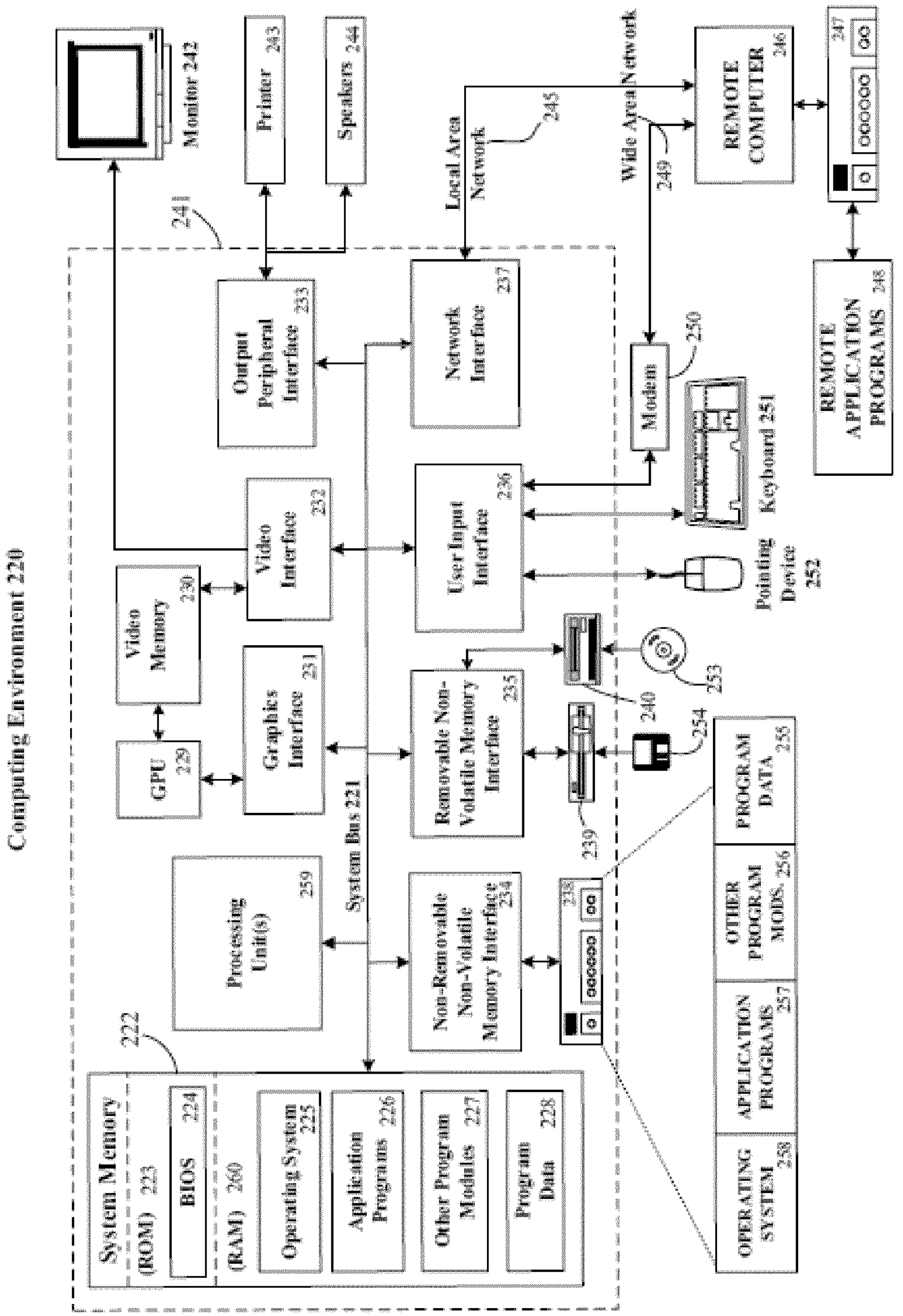
152
MEMORY UNIT 146
WIRELESS ADAPTER 148

FIG. 3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GPU 229
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Graphics Interface 231
Video Interface 232
Output Peripheral Interface 233
Non-Removable Non-Volatile Memory Interface 234
Removable Non-Volatile Memory Interface 235
User Input Interface 236
Network Interface 237
238
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240
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254
Pointing Device 252
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Modem 250
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Speakers 244
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245
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REMOTE APPLICATION PROGRAMS 248
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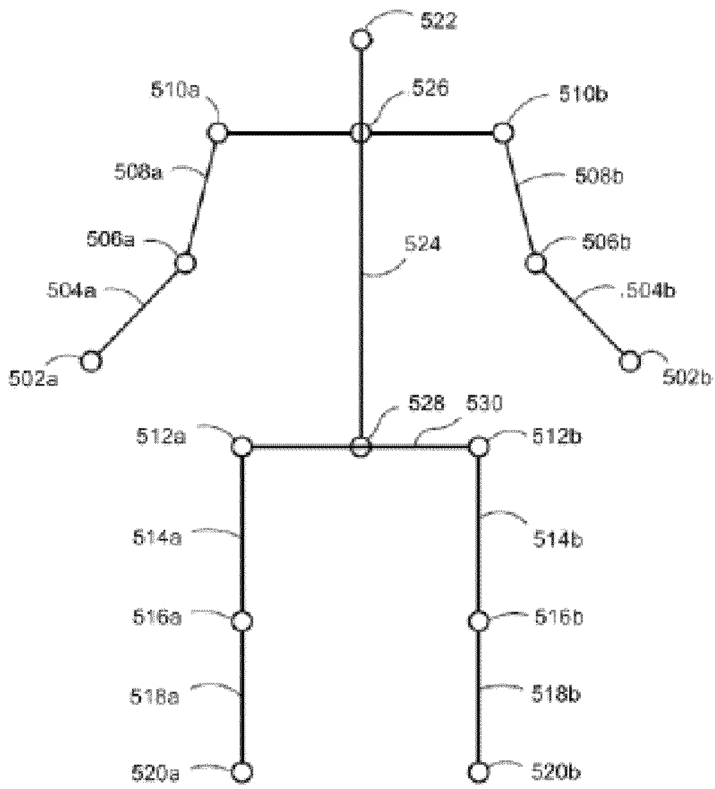
FIG. 4



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510a
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510b
508a
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506b
504a
.504b
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514a
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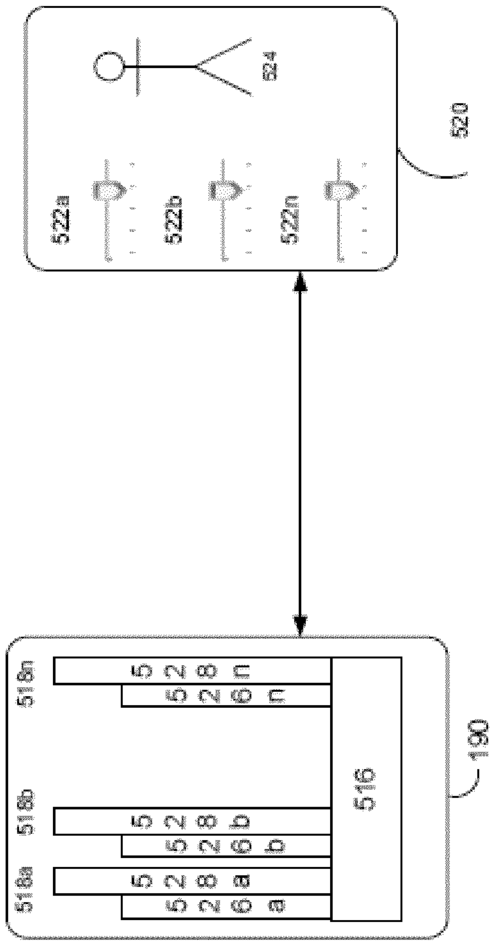
520a
520b

FIG. 5A



520
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518b
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526a
528b
526b
528n
526n

FIG. 5B

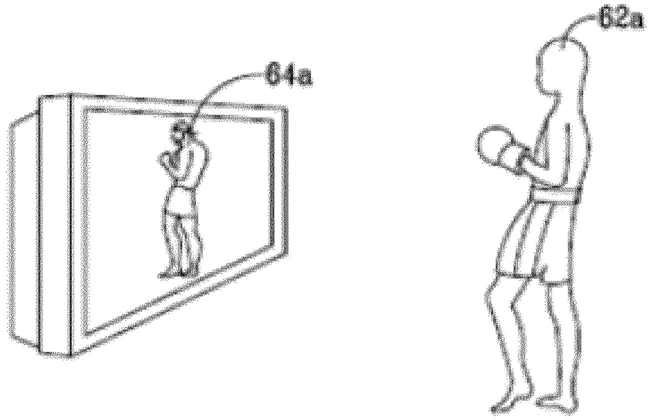

FIG. 6A

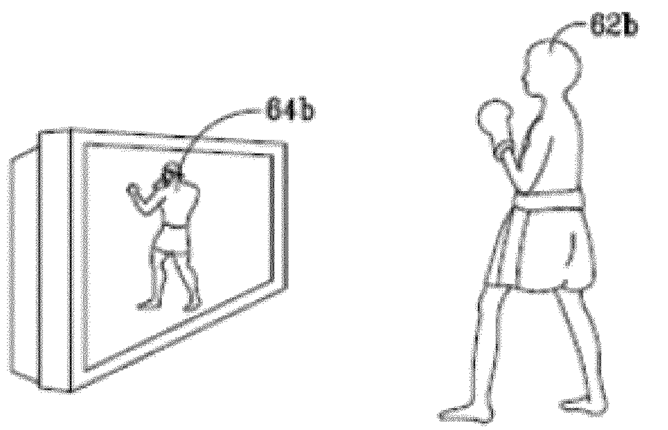

FIG. 6B

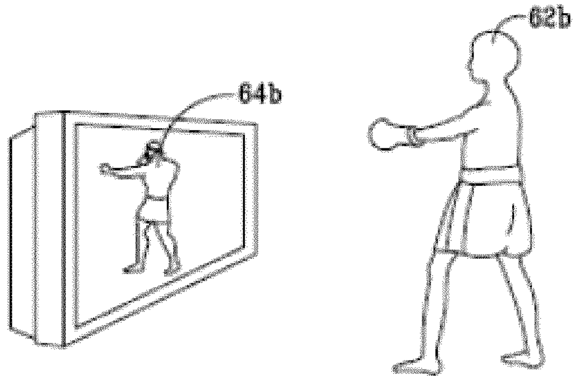

FIG. 6C

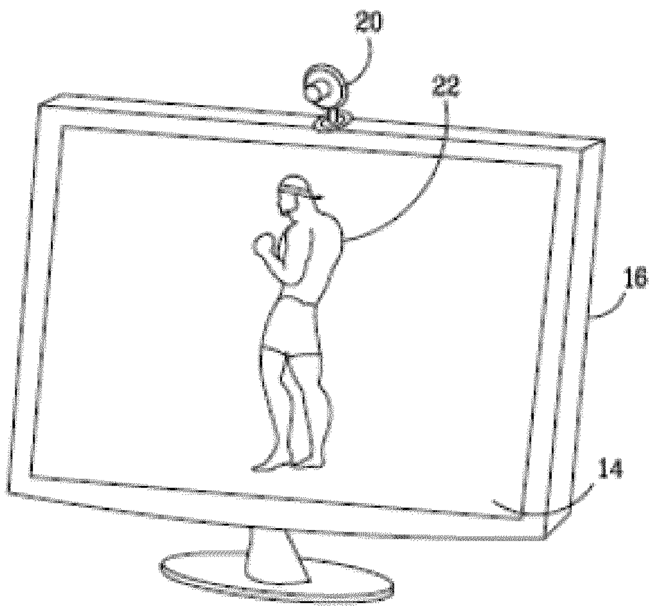

FIG. 6D

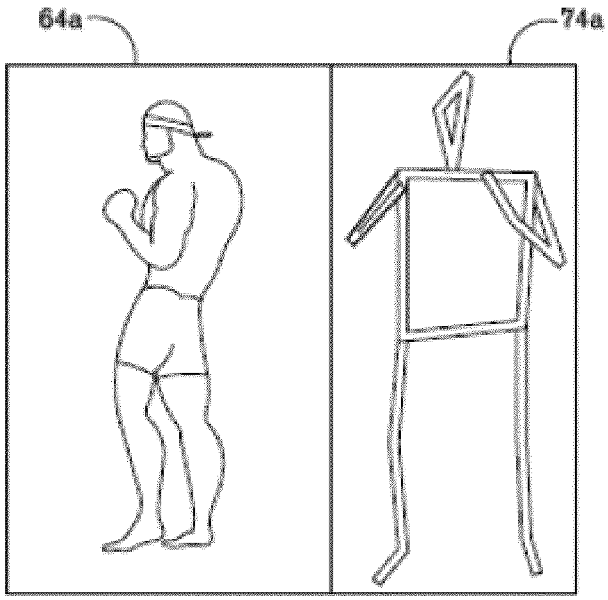

FIG. 7A

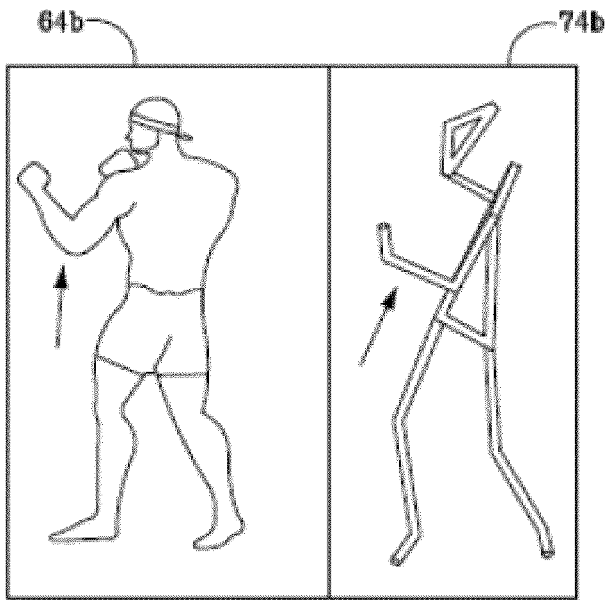

FIG. 7B

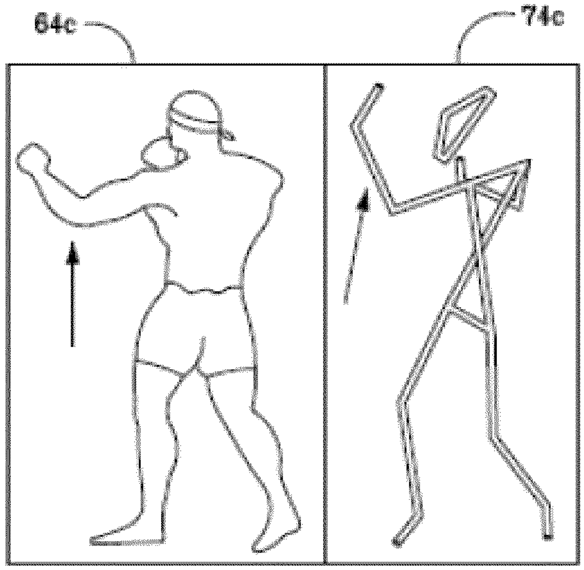

FIG. 7C

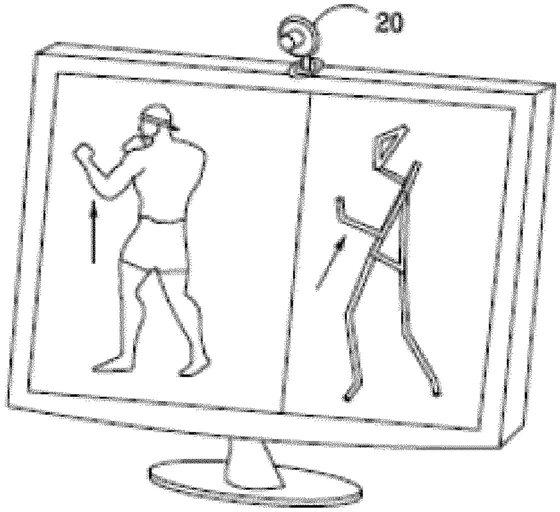

FIG. 7D

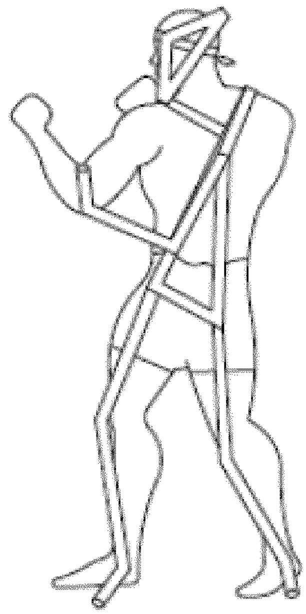

FIG. 8A

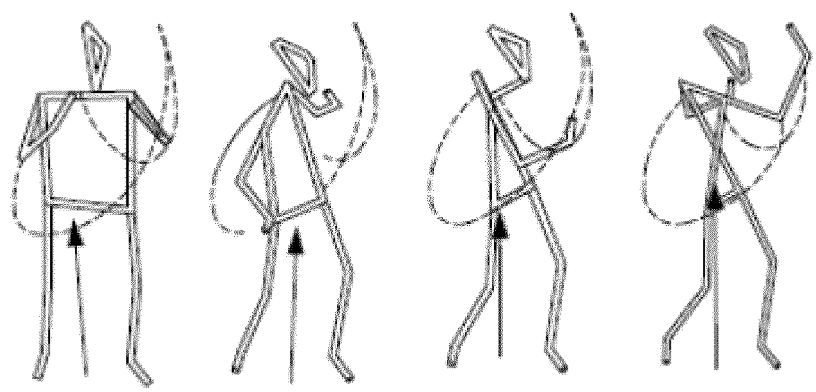

FIG. 8B

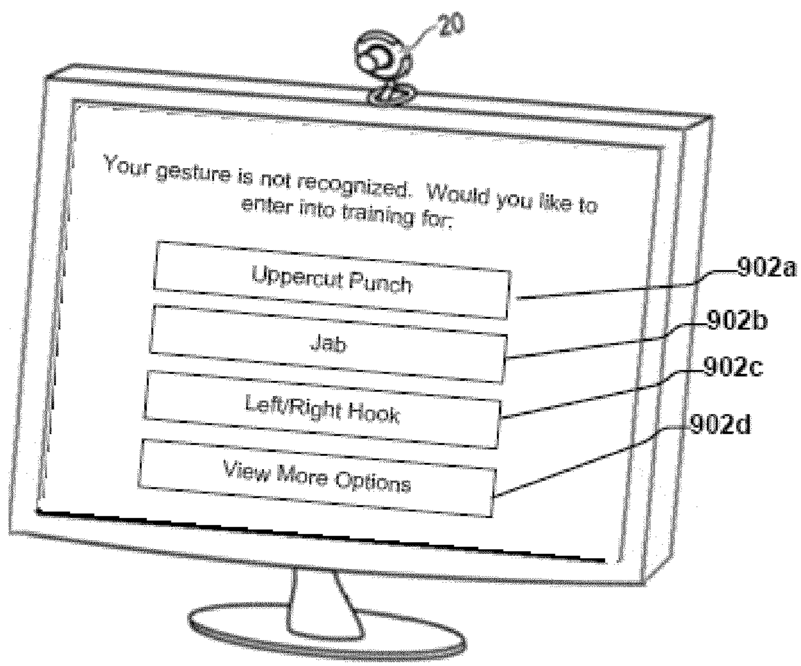
20
Your gesture is not recognized. Would you like to enter into training for:
Uppercut Punch
Jab
Left/Right Hook
View More Options
902a
902b
902c
902d

FIG. 9

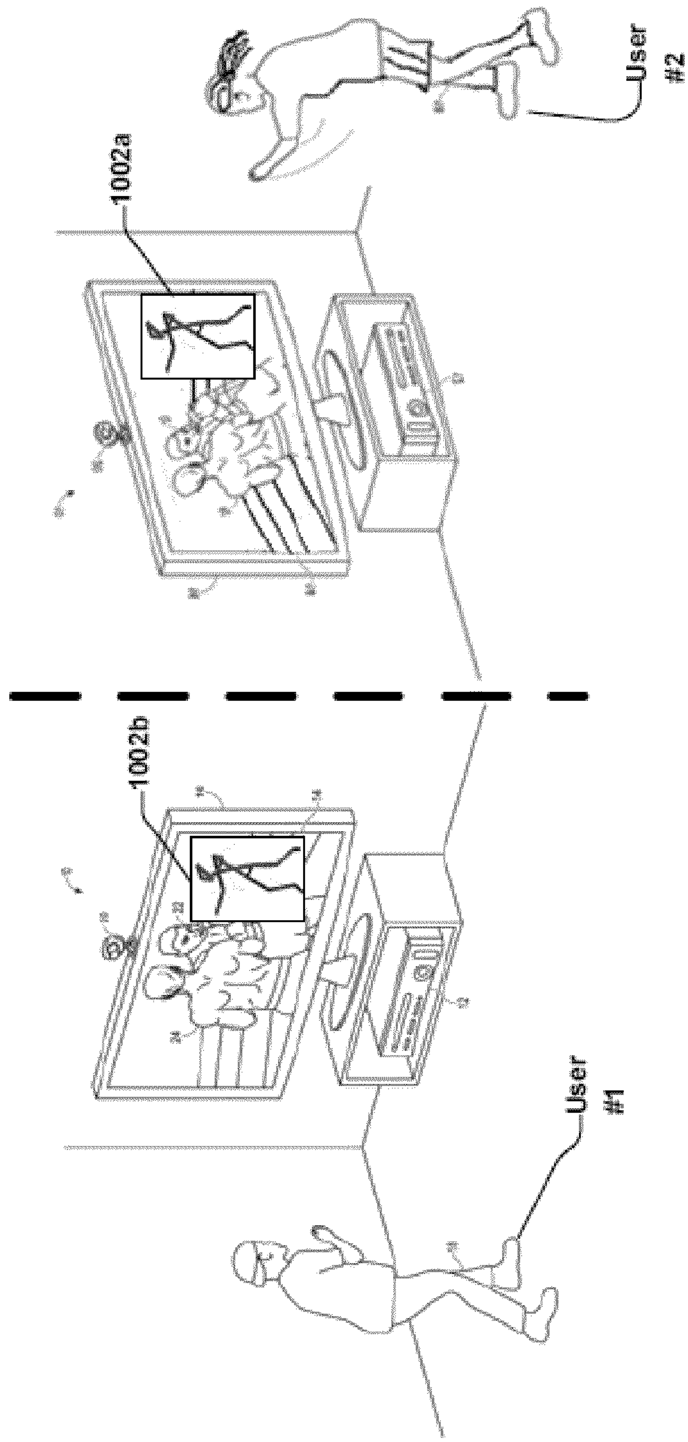

FIG. 10

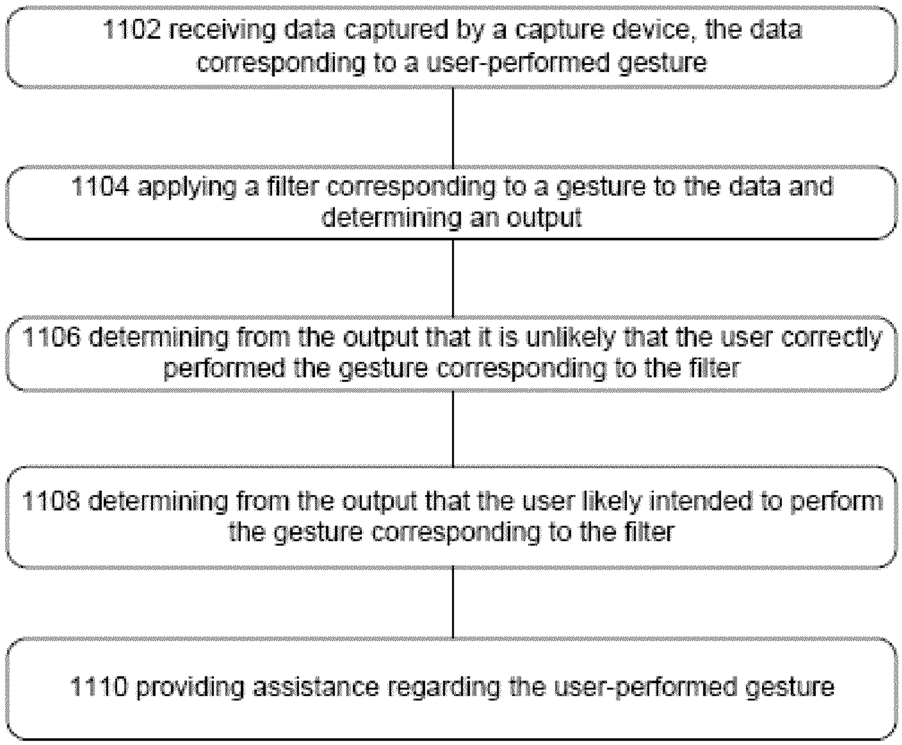
1102 receiving data captured by a capture device, the data corresponding to a user-performed gesture
1104 applying a filter corresponding to a gesture to the data and determining an output
1106 determining from the output that it is unlikely that the user correctly performed the gesture corresponding to the filter
1108 determining from the output that the user likely intended to perform the gesture corresponding to the filter
1110 providing assistance regarding the user-performed gesture

FIG. 11A

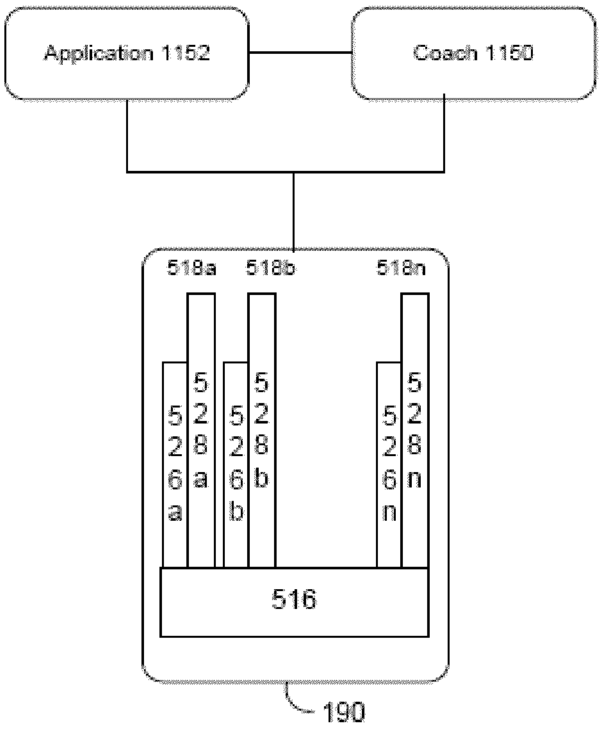

FIG. 11B

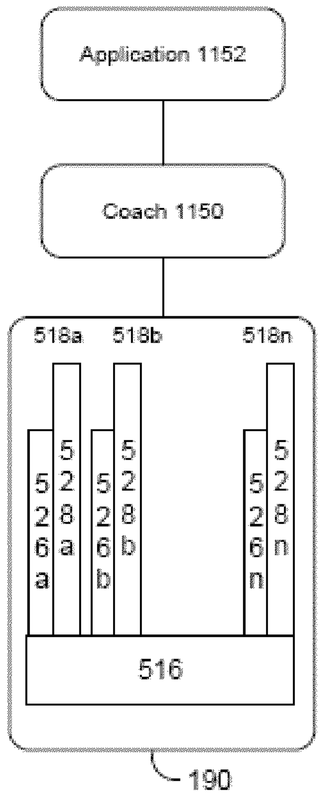

FIG. 11C

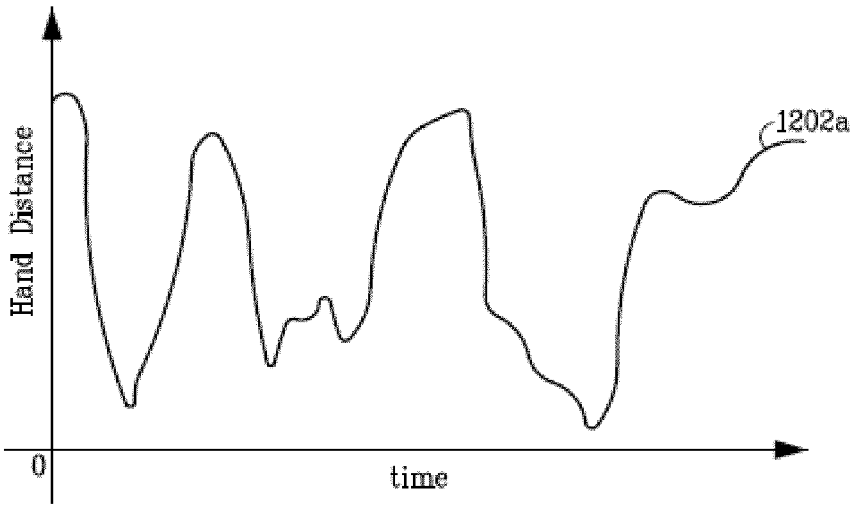

FIG. 12A

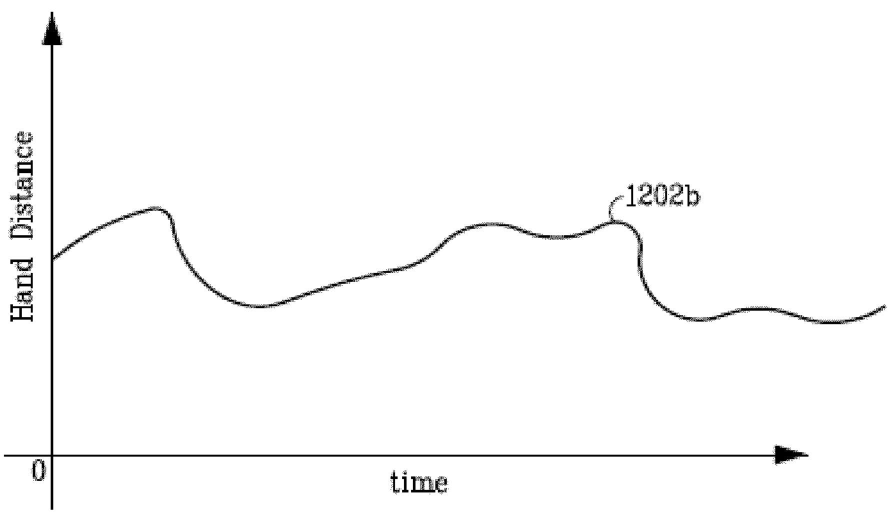

FIG. 12B

GESTURE COACH

BACKGROUND OF THE INVENTION

Many computing applications such as computer games, multimedia applications, office applications or the like use controls to allow users to manipulate game characters or other aspects of an application. Typically such controls are input using, for example, controllers, remotes, keyboards, mice, or the like. Unfortunately, such controls can be difficult to learn, thus creating a barrier between a user and such games and applications. Furthermore, such controls may be different than actual game actions or other application actions for which the controls are used. For example, a game control that causes a game character to swing a baseball bat may not correspond to an actual motion of swinging the baseball bat.

SUMMARY OF THE INVENTION

In some systems, a display device may display a model that maps to user motions that have been captured by the system. For example, the model may be displayed as an avatar on a screen, where that avatar's motion can be controlled by mapping the avatar's motion in an application space to the user's motions in the physical space. A user may be unfamiliar with a system that maps the user's motions. For example, the user may not know what gestures are applicable for an executing application. In some cases, a user will not understand or know how to perform the gestures that are applicable for the executing application. A written or pictoral description in a handbook may be insufficient to teach a user how to properly gesture.

Disclosed herein are systems and methods for gesture coaching. As the user attempts to make gestures, captured user data and output from gesture filters corresponding to that captured user data may be analyzed to determine that the user is attempting, but failing, to perform a gesture, and that providing assistance to the user is appropriate. This assistance may comprise teaching the user the proper way to perform the gesture. For example, where the output to a filter comprises a confidence level that the corresponding gesture was performed, and that confidence level is below a recognition threshold, it may be determined that assistance is appropriate to teach the user to perform the gesture in such a way that the corresponding confidence level is at or above that recognition threshold.

This Summary is provided to introduce a selection of concepts in a simplified form that are further described below in the Detailed Description. This Summary is not intended to identify key features or essential features of the claimed subject matter, nor is it intended to be used to limit the scope of the claimed subject matter. Furthermore, the claimed subject matter is not limited to implementations that solve any or all disadvantages noted in any part of this disclosure.

BRIEF DESCRIPTION OF THE DRAWINGS

The systems, methods, and computer readable media for gesture coaching, in accordance with this specification, are further described with reference to the accompanying drawings in which:

FIGS. **1**A and **1**B illustrate an example embodiment of a target recognition, analysis, and tracking system with a user playing a game.

FIG. **2** illustrates an example embodiment of a capture device that may be used in a target recognition, analysis, and tracking system and incorporate gesture coaching.

FIG. **3** illustrates another example embodiment of a computing environment in which the techniques disclosed herein for gesture coaching may be embodied.

FIG. **4** illustrates another example embodiment of a computing environment in which the techniques disclosed herein for gesture coaching may be embodied.

FIG. **5**A illustrates a skeletal mapping of a user that has been generated from a depth image.

FIG. **5**B illustrates further details of the gesture recognizer architecture shown in FIG. **2**.

FIGS. **6**A-**6**D illustrate another example embodiment of target recognition, analysis and tracking with a user playing a boxing game.

FIGS. **7**A-**7**D illustrate an example display of visual assistance side-by-side with a visual representation of a user's gestures.

FIG. **8**A illustrates an example display of visual assistance superimposed on a visual representation of a user's gestures.

FIG. **8**B illustrates an example display of visual assistance that comprises a demonstration of a gesture.

FIG. **9** illustrates an example display of options for entering into a training mode to receive visual assistance.

FIG. **10** illustrates remote users interacting over a network connection, where visual assistance of one user's motion is provided to the second user.

FIG. **11**A depicts example operating procedures for gesture coaching.

FIGS. **11**B and **11**C depict example architectures for gesture coaching integrated with a gesture recognizer engine and an application.

FIGS. **12**A and **12**B depict example filter outputs from which it may be determined that gesture coaching is appropriate.

DETAILED DESCRIPTION OF ILLUSTRATIVE EMBODIMENTS

As will be described herein, a user may control an application executing on a computing environment such as a game console, a computer, or the like by performing one or more gestures. Disclosed herein are systems and methods for demonstrating motions for desired gestures to the user. For example, the computing environment may provide visual assistance to train a user how to make the appropriate motions applicable to an executing application.

To generate models representative of a target or object in a physical space, a capture device can capture a depth image of the physical space and scan targets in the scene. A target may include humans or other objects in the scene. In one embodiment, the capture device may determine whether one or more targets in the scene corresponds to a human target such as the user. To determine whether a target in the scene corresponds to a human target, each of the targets may be flood filled and compared to a pattern of a human body model. A target identified as a human may be scanned to generate a skeletal model associated therewith. The skeletal model may then be provided to a computing environment for tracking the skeletal model and rendering an avatar associated with the skeletal model. The computing environment may map the motions of the user in the physical space to a visual representation on a display device, such as an avatar. The computing environment may determine which controls to perform in an application executing on the computer environment based on, for example, gestures of the user that have been recognized and mapped to the skeletal model. Thus, user assistance may be displayed, such as via an avatar on a screen, and the user can control that avatar's motion and execute controls of the operating system or executing application, for example, by making gestures in the physical space.

It may be desirable in some situations to provide visual assistance to teach a user how to gesture properly to control the executing application. For example, the user may not be aware of, or know how to perform, the motions that correspond to a particular gesture that is applicable to the executing application. The system may detect errors in the user's gestures, indicating that the user needs training to properly gesture.

Some of the functional units described in this specification have been labeled as modules, in order to more particularly emphasize their implementation independence. For example, a module may be implemented as a hardware circuit comprising custom VLSI circuits or gate arrays, off-the-shelf semiconductors such as logic chips, transistors, or other discrete components. A module may also be implemented in programmable hardware devices such as field programmable gate arrays, programmable array logic, programmable logic devices or the like.

Modules may also be implemented in software for execution by various types of processors. An identified module of executable code may, for instance, comprise one or more physical or logical blocks of computer instructions which may, for instance, be organized as an object, procedure, or function. Nevertheless, the executables of an identified module need not be physically located together, but may comprise disparate instructions stored in different locations which, when joined logically together, comprise the module and achieve the stated purpose for the module.

The system, methods, and components of providing visual training assistance as described herein may be embodied in a multi-media console, such as a gaming console, or in any other computing device in which it is desired to provide visual assistance, by way of example and without any intended limitation, satellite receivers, set top boxes, arcade games, personal computers (PCs), portable telephones, personal digital assistants (PDAs), and other hand-held devices.

FIGS. **1**A and **1**B illustrate an example embodiment of a configuration of a target recognition, analysis, and tracking system **10** with a user **18** playing a boxing game. In an example embodiment, the system **10** may recognize, analyze, and/or track a human target such as the user **18**. The system **10** may gather information related to the user's gestures in the physical space.

The system **10** may provide visual assistance to a user to demonstrate desired gestures. The provision of the visual assistance may be triggered in a number of ways. For example, the system may detect an error in the user's motion or a deviation from an expected motion. The detection of such error or deviation may trigger visual assistance that demonstrates the desired gesture. In another example, the executing application may provide visual assistance for training purposes to demonstrate the appropriate motions for control. Assistance may take a variety of forms such as tactile, auditory and visual. In an embodiment, the assistance consists of an audio assistance, visual assistance, changing the color of a display element, lining of a display element, fading of a display element, strobing of a display element, a tracer pattern of some combination of these forms of assistance.

As shown in FIG. **1**A, the target recognition, analysis, and tracking system **10** may include a computing environment **12**. The computing environment **12** may be a computer, a gaming system or console, or the like. According to an example embodiment, the computing environment **12** may include hardware components and/or software components such that the computing environment **12** may be used to execute applications such as gaming applications, non-gaming applications, or the like.

As shown in FIG. **1**A, the target recognition, analysis, and tracking system **10** may further include a capture device **20**. The capture device **20** may be, for example, a camera that may be used to visually monitor one or more users, such as the user **18**, such that gestures performed by the one or more users may be captured, analyzed, and tracked to perform one or more controls or actions within an application, as will be described in more detail below.

According to one embodiment, the target recognition, analysis, and tracking system **10** may be connected to an audiovisual device **16** such as a television, a monitor, a high-definition television (HDTV), or the like that may provide game or application visuals and/or audio to a user such as the user **18**. For example, the computing environment **12** may include a video adapter such as a graphics card and/or an audio adapter such as a sound card that may provide audiovisual signals associated with the game application, non-game application, or the like. The audiovisual device **16** may receive the audiovisual signals from the computing environment **12** and may then output the game or application visuals and/or audio associated with the audiovisual signals to the user **18**. According to one embodiment, the audiovisual device **16** may be connected to the computing environment **12** via, for example, an S-Video cable, a coaxial cable, an HDMI cable, a DVI cable, a VGA cable, or the like.

As shown in FIGS. **1**A and **1**B, the target recognition, analysis, and tracking system **10** may be used to recognize, analyze, and/or track a human target such as the user **18**. For example, the user **18** may be tracked using the capture device **20** such that the movements of user **18** may be interpreted as controls that may be used to affect the application being executed by computer environment **12**. Thus, according to one embodiment, the user **18** may move his or her body to control the application.

As shown in FIGS. **1**A and **1**B, in an example embodiment, the application executing on the computing environment **12** may be a boxing game that the user **18** may be playing. For example, the computing environment **12** may use the audiovisual device **16** to provide a visual representation of a boxing opponent **38** to the user **18**. The computing environment **12** may also use the audiovisual device **16** to provide a visual representation of a player avatar **40** that the user **18** may control with his or her movements. For example, as shown in FIG. **1**B, the user **18** may throw a punch in physical space to cause the player avatar **40** to throw a punch in game space. Thus, according to an example embodiment, the computer environment **12** and the capture device **20** of the target recognition, analysis, and tracking system **10** may be used to recognize and analyze the punch of the user **18** in physical space such that the punch may be interpreted as a game control of the player avatar **40** in game space.

Other movements by the user **18** may also be interpreted as other controls or actions, such as controls to bob, weave, shuffle, block, jab, or throw a variety of different power punches. Furthermore, some movements may be interpreted as controls that may correspond to actions other than controlling the player avatar **40**. For example, the player may use movements to end, pause, or save a game, select a level, view high scores, communicate with a friend, etc.

As described in more detail below, the system **10** may provide visual assistance to the user **18** to demonstrate gestures that are applicable to the executing application. In an example embodiment, the visual assistance is prerecorded content in the form of a skeletal representation, a ghosted image, or a player avatar. In another example embodiment, live content may be presented to the user.

In example embodiments, the human target such as the user **18** may have an object. In such embodiments, the user of an electronic game may be holding the object such that the motions of the player and the object may be used to adjust and/or control parameters of the game. For example, the motion of a player holding a racket may be tracked and utilized for controlling an on-screen racket in an electronic sports game. In another example embodiment, the motion of a player holding an object may be tracked and utilized for controlling an on-screen weapon in an electronic combat game. The system **10** may provide visual assistance for demonstrating the gestures related to the user's motion with respect to the object the player is holding in the physical space and/or in the application space.

According to other example embodiments, the target recognition, analysis, and tracking system **10** may further be used to interpret target movements as operating system and/or application controls that are outside the realm of games. For example, virtually any controllable aspect of an operating system and/or application may be controlled by movements of the target such as the user **18**. And the system **10** may provide visual assistance for demonstrating the gestures related to any controllable aspect of the operating system and/or application.

FIG. **2** illustrates an example embodiment of the capture device **20** that may be used in the target recognition, analysis, and tracking system **10**. According to an example embodiment, the capture device **20** may be configured to capture video with depth information including a depth image that may include depth values via any suitable technique including, for example, time-of-flight, structured light, stereo image, or the like. According to one embodiment, the capture device **20** may organize the calculated depth information into "Z layers," or layers that may be perpendicular to a Z axis extending from the depth camera along its line of sight.

As shown in FIG. **2**, the capture device **20** may include an image camera component **22**. According to an example embodiment, the image camera component **22** may be a depth camera that may capture the depth image of a scene or an RGB camera **28** that may capture the color from the scene. The depth image may include a two-dimensional (2-D) pixel area of the captured scene where each pixel in the 2-D pixel area may represent a length in, for example, centimeters, millimeters, or the like of an object in the captured scene from the camera.

As shown in FIG. **2**, according to an example embodiment, the image camera component **22** may include an IR light component **24**, a three-dimensional (3-D) camera **26**, and an RGB camera **28** that may be used to capture the depth image of a scene. For example, in time-of-flight analysis, the IR light component **24** of the capture device **20** may emit an infrared light onto the scene and may then use sensors (not shown) to detect the backscattered light from the surface of one or more targets and objects in the scene using, for example, the 3-D camera **26** and/or the RGB camera **28**. In some embodiments, pulsed infrared light may be used such that the time between an outgoing light pulse and a corresponding incoming light pulse may be measured and used to determine a physical distance from the capture device **20** to a particular location on the targets or objects in the scene. Additionally, in other example embodiments, the phase of the outgoing light wave may be compared to the phase of the incoming light wave to determine a phase shift. The phase shift may then be used to determine a physical distance from the capture device to a particular location on the targets or objects.

According to another example embodiment, time-of-flight analysis may be used to indirectly determine a physical distance from the capture device **20** to a particular location on the targets or objects by analyzing the intensity of the reflected beam of light over time via various techniques including, for example, shuttered light pulse imaging.

In another example embodiment, the capture device **20** may use a structured light to capture depth information. In such an analysis, patterned light (i.e., light displayed as a known pattern such as grid pattern or a stripe pattern) may be projected onto the scene via, for example, the IR light component **24**. Upon striking the surface of one or more targets or objects in the scene, the pattern may become deformed in response. Such a deformation of the pattern may be captured by, for example, the 3-D camera **26** and/or the RGB camera **28** and may then be analyzed to determine a physical distance from the capture device to a particular location on the targets or objects.

According to another embodiment, the capture device **20** may include two or more physically separated cameras that may view a scene from different angles, to obtain visual stereo data that may be resolved to generate depth information

The capture device **20** may further include a microphone **30**. The microphone **30** may include a transducer or sensor that may receive and convert sound into an electrical signal. According to one embodiment, the microphone **30** may be used to reduce assistance between the capture device **20** and the computing environment **12** in the target recognition, analysis, and tracking system **10**. Additionally, the microphone **30** may be used to receive audio signals that may also be provided by the user to control applications such as game applications, non-game applications, or the like that may be executed by the computing environment **12**.

In an example embodiment, the capture device **20** may further include a processor **32** that may be in operative communication with the image camera component **22**. The processor **32** may include a standardized processor, a specialized processor, a microprocessor, or the like that may execute instructions that may include instructions for receiving the depth image, determining whether a suitable target may be included in the depth image, converting the suitable target into a skeletal representation or model of the target, or any other suitable instruction.

The capture device **20** may further include a memory component **34** that may store the instructions that may be executed by the processor **32**, images or frames of images captured by the 3-D camera or RGB camera, or any other suitable information, images, or the like. According to an example embodiment, the memory component **34** may include random access memory (RAM), read only memory (ROM), cache, Flash memory, a hard disk, or any other suitable storage component. As shown in FIG. **2**, in one embodiment, the memory component **34** may be a separate component in communication with the image capture component **22** and the processor **32**. According to another embodiment, the memory component **34** may be integrated into the processor **32** and/or the image capture component **22**.

As shown in FIG. **2**, the capture device **20** may be in communication with the computing environment **12** via a communication link **36**. The communication link **36** may be a wired connection including, for example, a USB connection, a Firewire connection, an Ethernet cable connection, or the like and/or a wireless connection such as a wireless 802.11b, g, a, or n connection. According to one embodiment, the computing environment **12** may provide a clock to the capture device **20** that may be used to determine when to capture, for example, a scene via the communication link **36**.

Additionally, the capture device **20** may provide the depth information and images captured by, for example, the 3-D camera **26** and/or the RGB camera **28**, and a skeletal model that may be generated by the capture device **20** to the computing environment **12** via the communication link **36**. The computing environment **12** may then use the skeletal model, depth information, and captured images to, for example, recognize user gestures and in response control an application such as a game or word processor. For example, as shown, in FIG. **2**, the computing environment **12** may include a gesture recognition engine **190** and a gestures library **192** containing one or more gesture filters **191**.

Each filter **191** may comprise information defining a gesture along with parameters, or metadata, for that gesture. The data captured by the cameras **26**, **28** and device **20** in the form of the skeletal model and movements associated with it may be compared to the gesture filters in the gesture library **192** to identify when a user (as represented by the skeletal model) has performed one or more gestures. Inputs to a filter such as filter **191** may comprise things such as joint data about a user's joint position, like angles formed by the bones that meet at the joint, RGB color data from the scene, and the rate of change of an aspect of the user.

For instance, a throw, which comprises motion of one of the hands from behind the rear of the body to past the front of the body, may be implemented as a gesture filter comprising information representing the movement of one of the hands of the user from behind the rear of the body to past the front of the body, as that movement would be captured by a depth camera. Image data from the scene may also be captured from an RGB camera. As mentioned, parameters may be set for the gesture. Where the gesture is a throw, a parameter may be a threshold velocity that the hand has to reach, a distance the hand must travel (either absolute, or relative to the size of the user as a whole), and a confidence rating by the recognizer engine that the gesture occurred. These parameters for the gesture may vary between applications, between contexts of a single application, or within one context of one application over time.

Outputs from a filter **191** may comprise things such as the confidence that a given gesture is being made, the speed at which a gesture motion is made, and a time at which a gesture motion is made. The gestures may be associated with various controls of an application. Thus, the computing environment **12** may use the gesture recognizer engine **190** to interpret movements of the skeletal model and to control an application based on the movements.

In an embodiment, a gesture filter comprises an algorithm that accepts one or more pieces of data regarding the user as input, and returns one or more outputs regarding the corresponding gesture. For instance, a "user height" gesture filter algorithm may take a skeletal map of a user as input, process that data, and return an output of the height of the user as calculated by the algorithm.

The computing environment **12** may include a processor **195** that can process the depth image to determine what objects are in a scene, such as a user **18** or an object in the room. This can be done, for instance, by grouping together of pixels of the depth image that share a similar distance value. The image may also be parsed to produce a skeletal representation of the user, where features, such as joints and tissues that run between joints is identified. There exist skeletal mapping techniques to capture a person with a depth camera and from that determine various spots on that user's skeleton, joints of the hand, wrists, elbows, knees, nose, ankles, shoulders, and where the pelvis meets the spine. Other techniques include transforming the image into a body model representation of the person and transforming the image into a mesh model representation of the person.

In an embodiment, the processing is performed on the capture device **20** itself, and the raw image data of depth and color (where the capture device comprises a **3**D camera) values are transmitted to the computing environment **12** via link **36**. In another embodiment, the processing is performed by a processor **32** coupled to the camera **402** and then the parsed image data is sent to the computing environment **12**. In still another embodiment, both the raw image data and the parsed image data are sent to the computing environment **12**. The computing environment **12** may receive the parsed image data but it may still receive the raw data for executing the current process or application. For instance, if an image of the scene is transmitted across a computer network to another user, the computing environment **12** may transmit the raw data for processing by another computing environment.

The computing environment **12** may use the gestures library **192** to interpret movements of the skeletal model and to control an application based on the movements. The computing environment **12** can model and display a representation of a user, such as in the form of an avatar or a pointer on a display, such as on a display device **194**. Display device **194** may include a computer monitor, a television screen, or any suitable display device. For example, a camera-controlled computer system may capture user image data and display user assistance on a television screen that maps to the user's gestures. The user assistance may be displayed as an avatar on the screen such as shown in FIGS. **1**A and **1**B.

The visual assistance library **193** may comprise information related to the visual assistance for a collection of gestures. The visual assistance library **193** may provide information to the display device **194** for the display of a visual representation of instructional gesture data. For example, the display device may display a skeletal representation, a ghosted image, or a player avatar that can demonstrate a gesture. As described in more detail below, FIGS. **7**A-**7**D illustrate both the user assistance and the visual assistance comprising instructional gesture data, shown side by side. FIG. **8**A illustrates an example display of visual assistance superimposed on a visual representation of a user's gestures. FIG. **8**B illustrates an example display of visual assistance that comprises a demonstration of a gesture. FIG. **9** illustrates an example display of options for entering into a training mode to receive visual assistance. FIG. **10** illustrates remote users interacting over a network connection, where one user provides live visual assistance to the second user.

Various events may trigger the display of visual assistance for gesture demonstration. The system may detect errors in the user's motion, the user's motion may not correspond to a recognized gesture, the user may request training to learn a particular gesture, etc. An analysis of the user's motion may trigger the application to provide visual assistance to the user, or an option to view visual assistance, to teach the proper motion for, for example, throwing gestures recognized by the application. As described, the visual assistance may be in the form of a skeletal representation that demonstrates, for example, the proper overhand throwing gesture. The parameters and error identifiers for the gesture may vary between applications, between contexts of a single application, or within one context of one application over time.

The visual assistance information may be provided for training, correcting, modifying, or teaching a user to properly move in the physical space, to trigger a particular motion, or to properly move for success in the application. For example, the user may be playing a boxing game. The computing environment **12** may identify a gesture that is applicable to the executing application, such as an uppercut punch, and direct the display device **194** to provide the visual assistance comprising instructions for how to perform the uppercut punch. The visual assistance could be an avatar on a screen that demonstrates the proper motion for the uppercut punch.

A gesture filter **191** in the gestures library **192** that can recognize, track, or identify a gesture may also identify when visual assistance should be provided. For instance, where the gesture is an overhand throw, the data captured by the cameras **26**, **28** and device **20** in the form of the skeletal model and movements associated with it may be compared to the gesture filters in the gesture library **192**. An output of a filter may be the identification that the user (as represented by the skeletal model) is performing an overhand throwing gesture. An overhand throw, which comprises motion of one of the hands from behind the rear of the body to past the front of the body, may be implemented as a gesture filter comprising information representing the movement of one of the hands of the user from behind the rear of the body to past the front of the body, as that movement would be captured by a depth camera.

The variation between the user's gestures and the parameters set in the filter for an overhand throwing gesture may indicate a failure in the user's gesture and trigger entry into a training mode to teach the user the proper motion. The detection of an error or a change in the identified gesture based on filter parameters may trigger the display of visual assistance. Parameters may be set for an overhand throw that assist in identifying errors in the user's gesture. For example, the system may be executing a baseball game application. An overhand throwing gesture may have as a parameter a volume of space in which the user's arm should move. If a gesture filter **191** identifies, in the identified overhand throwing motion, that the user's arm has traveled outside the volume of space, this may be indicative of an error in the user's motion rather than a transition to a different gesture. The application may be expecting an overhand throwing gesture because the game is at a point where the user is pitching to a batter. The failure to recognize the user's gestures as the expected overhand throwing gesture may trigger the display of visual assistance. The gesture filter may not recognize the gesture as an overhand throwing gesture anymore because the motion no longer meets the parameters for an overhand throw, but instead meets the filter parameters for a different gesture, such as an underhand throwing motion. An unexpected transition between different gestures may trigger the display of visual assistance.

As mentioned, parameters may be set for a gesture. For example, where the gesture is a throw, a parameter may be a threshold velocity that the hand has to reach, a distance the hand must travel (either absolute, or relative to the size of the user as a whole), and a confidence rating by the recognizer engine that the gesture occurred. Various thresholds and ranges may be set for the parameters that indicate an error in the user's gesture. For example, the volume of space through which a user's arm should move could vary in size depending on the skill level of the user.

The parameters that correspond to each gesture may vary based on a user's performance, the executing application, a context, a skill level, or the like. For example, a parameter for an overhand football throw in a "beginner" skill level may comprise a larger volume of space through which the hand can travel such that the system associates the gesture with an overhand throw and processes it accordingly. By varying certain parameters associated with a gesture, the system can accommodate less experienced players.

Several possible gestures may correspond to the user's gesture. For example, a user's gesture measured in the physical space may meet the criteria of several filters, each comprising parameters for possible gestures. The variations between the data representative of the measured gesture and the filter parameters for possible gestures may indicate a failure in the execution of the measured gesture.

If the data representative of the user's gesture does not correspond to any filter parameters for possible gestures, it is likely that the user is not performing the gesture properly as it relates to the executing application. It may be desirable to trigger a training session for a user if the user's gestures are not registering as one of the possible gestures.

The system can predict the intention of the user's gesture if the user's gesture does not correspond to any filter data. The system may predict an intended gesture based on what gesture would be applicable for the executing application at that point in time. The prediction may be based on a comparison of the data representative of the measured gesture and the filter parameters and identifying the gesture(s) with parameters that more closely match the measured gesture data.

Variations between the data representative of the measured gesture and the filter parameters for possible gestures may indicate a failure in the execution of the measured gesture. The variation can be compared to a threshold level of acceptance, where a variance amount that is below the threshold may trigger visual assistance with instructional gesture data. The threshold level of acceptance could be related to the confidence rating. As described above, outputs from a filter may comprise things such as the confidence that a given gesture is being made. A low confidence rating may be an indication that a user is not gesturing properly. The threshold level of acceptance may be set based on the confidence rating. For example, if the gesture is identified by the gesture recognizer engine as an overhand throw, and the confidence rating is low, the system may trigger the display of visual assistance with instructional gesture data. Alternately, the system may require a high confidence rating such that there is a higher confidence that the user is attempting the particular gesture. The visual assistance may trigger when variations between the data representative of the measured gesture and filter parameters are below a threshold level of acceptance.

The threshold level of acceptance could be a value set for a certain filter parameter. Each parameter of a filter that represents a gesture could have a threshold level of acceptance. The threshold level of acceptance could be a single threshold value or a range of acceptable values. If a measurement of the user's measured gesture does not meet the threshold level or fall within the acceptable range, it may be desirable to display visual assistance comprising instructional gesture data. For example, the threshold level of acceptance for an overhand throw, as it applies to a pitching motion in a baseball game, may be set as a velocity equal to 25 mph. Thus, if the user's gesture is identified as an overhand throw, the velocity parameter of the filter for an overhand throw may be compared to the velocity of the user's measured gesture. If the user's measured velocity does not meet 25 mph, this may trigger the display of visual assistance to teach the user how to properly motion to reach the proper velocity.

The threshold level of acceptance may be set, modified, or changed depending on the context, a user, the gesture-based system, history data for a user, history data for an application, an identity of improvement, etc. The threshold level could be an acceptable amount of variance from a preferred parameter or from a range of parameter values associated with a possible gesture. The values for a threshold level of acceptance may be based on a user's performance, the executing application, a context, a skill level, or the like. The threshold level of acceptance may be based on a single filter parameter or a plurality of filter parameters for a particular gesture. Similarly, the system can adapt the threshold level of acceptance for a gesture. For example, the threshold levels may be modified over time, changed by a user, the system or an application, for example.

Filter parameters and threshold levels of acceptance may be set such that the triggers for visual assistance are not in excess or are in accordance with user preferences. For example, some users may not want any training assistance or a user may not want to interrupt the executing application for training sessions, but rather select a training mode for instructional purposes. Rather than trigger the visual assistance every time there is a variation from filter data for a gesture, the system may determine whether or not to display the instructional gesture data based on various triggers.

The filter parameters and threshold levels of acceptance for error identification may be modified such that the visual assistance only triggers at useful times. For example, a gesture for an overhand throw may need to be recognized X number of times before assistance will be offered. Thus, the system can monitor a user's motion and not give assistance until a certain number of incorrect or varied motions. That way, it doesn't trigger if one mistake throw is made. But, if the program identifies something the user could change, even if they are executing the gesture with success, the system may provide an option for training For example, if a user's overhand throw is identified, the system may identify that a change to the user's lower body could generate more velocity, or a change in the user's follow-through could create a curve ball motion.

If an inexperienced or beginner user is playing a throwing game, the filter parameters defining the volume of space may be larger allowing a larger margin of error before triggering visual assistance for the gesture. The user may also request that visual assistance be provided when the user is not meeting a particular skill level. The user may request visual assistance to help attain a higher skill level. The threshold of parameters may change depending on the skill level of the user. For example, a volume of space for a punch or an overhand throw may have a larger acceptable margin of error for a beginner player. Thus, the trigger for entering training mode or providing visual assistance may change depending on the parameters of the application, settings selected by the user, the type of training available for the application, etc.

The visual assistance library **193** may comprise modules that provide access to, store, and process visual assistance information for demonstrating a gesture. The visual assistance may be specific to an application, to a user, or to a particular gesture. Some gestures are applicable to a particular application, where the same gesture in another application results in a different control. For example, in one application, waving a hand may be the gesture that represents flying; in another application, holding both arms up and slowly swaying them back in forth may be the gesture that represents flying.

The information related to the visual assistance in the visual assistance library **193** may take any suitable form. In an example embodiment, the visual assistance is in the form of prerecorded content, i.e., content that is recorded during a stage prior to use of that content. The prerecorded content module **196** may record or store prerecorded content that supports the display of a demonstration of a gesture, such as prerecorded audio or visual related to a gesture. The prerecorded content module **196** may provide techniques for connecting to a network and receiving prerecorded gesture information from a remote server or via the computing environment of a networked user. The prerecorded content module **196** can process the prerecorded content to provide visual assistance for the gesture, such as by displaying a skeletal representation, a ghosted image, or a player avatar that demonstrates the gesture.

The prerecorded content may be specific to an application, to a user, to a gesture, or the prerecorded content may be applicable across applications or to a combination of users. The prerecorded content may be gesture information that was packaged in the visual assistance library **193** of a particular application. For example, if the application is a tennis game application, the application may include a visual assistance library with prerecorded gesture information for displaying tennis related gestures.

The prerecorded content may comprise content recorded by a user, where a user selects to record his or her own gestures for reviewing or for later use. For example, a user may be successful in a tennis game with a particular motion and record it such that, at a later time, the user can access the prerecorded content to view the prerecorded gesture. The user may then view his or her own prerecorded gesture for a demonstration of a gesture that the user has had success with in the past. The user may record gesture content that the system can use for demonstrating gestures to inexperienced users. For example, a parent may record his or her own successful gesture for review by a child. The child can later view and practice using the prerecorded gesture to learn the proper motions to make in the physical space.

In another example embodiment, the visual assistance is in the form of live content, i.e., any information related to providing real-time visual assistance of a gesture. A real-time display refers to the display of a visual representation of a gesture or display of visual assistance, wherein the display is simultaneously or almost simultaneously displayed with the performance of the gesture in the physical space. References to real-time include performance, wherein insignificant processing delays result in minimal delay of the display or are not visible at all to the user. Thus, real-time includes any insignificant delays pertaining to the timeliness of data which has been delayed by the time required for automatic data processing.

The live content module **197** may provide techniques for receiving, processing, and transmitting the live content. For example, the live content module **197** may provide techniques for connecting to a network and receiving a live feed containing gesture information from a remote server or from the computing environment of a networked user. The live content module **197** can process the live feed comprising gesture information to display in a real-time demonstration of a gesture. For example, a remote user could demonstrate a gesture, where information related to the remote user's gestures are transmitted over a network and received by a local user's computing environment. The local computing environment could process the live feed, such as via the live content module, and display visual assistance to a local user in real-time. The visual assistance could be a replay or a live representation of the user's gesture, represented via a visual representation of the user. The live content module **197** can display the visual assistance in any suitable manner, such as by displaying a skeletal representation, a ghosted image, or a player avatar that demonstrates the gesture.

The live content may be specific to an application or to a user, or the live content may be applicable across applications or to a combination of users. For example, live customer support may be accessible for a particular application from a remote computing environment, where the live customer support provides a live feed of gesture information. The live content module **197** may receive the live feed and provide visual assistance to a user that represents the gesture in real-time as the user is gesturing.

In another example of live assistance, users may be remotely connected or networked such that multiple users can interact via their respective computing environments. A first user may recognize that a second user, remote to the first, is performing a gesture incorrectly. The first user can provide a demonstration of the gesture to the user via the networked connection. The second user's computing environment, via the live content module **197**, for example, may receive information related to the demonstrated gesture and provide visual assistance to the second user. Therefore, a first user can provide live gesture information to a second user to help the second user learn the proper motions to make in the physical space.

The gesture recognizer engine **190**, gestures library **192**, and visual assistance library **193** may be implemented in hardware, software or a combination of both. For example, the gestures recognition engine **190**, gestures library **192**, and visual assistance library **193** may be implemented as software that executes on a processor, such as processor **195**, of the computing environment, processor **32** of the capture device **20**, on processing unit **101** of FIG. **3**, or processing unit **259** of FIG. **4**.

It is emphasized that the block diagram depicted in FIGS. **2-4** are exemplary and not intended to imply a specific implementation. Thus, the processor **195** or **32** in FIG. **1**, the processing unit **101** of FIG. **3**, and the processing unit **259** of FIG. **4**, can be implemented as a single processor or multiple processors. Multiple processors can be distributed or centrally located. For example, the gesture recognition engine **190** may be implemented as software that executes on the processor **32** of the capture device and the gestures library and visual assistance library **193** may be implemented as software that executes on the processor **195** in the computing environment. Any combination of processors that are suitable for performing the techniques disclosed herein are contemplated. Multiple processors can communicate wirelessly, via hard wire, or a combination thereof

FIG. **2** depicts the capture device **20** and the computing environment **12** separately, but it is contemplated that a system comprising any number of devices can perform the functionality shown in FIG. **2**. For example, the computing environment may be incorporated into the capture device **20** such that the capture device can function as a single unit with one or more processors. Thus, while the computing environment **12** and capture device **20** are described separately herein, this is for illustration purposes. Any suitable device, system, or combination of devices and systems that can perform the disclosed techniques may be used.

FIG. **3** illustrates an example embodiment of a computing environment that may be used to implement the computing environment **12** of FIG. **2** to interpret one or more gestures in a target recognition, analysis, and tracking system. As showin in FIG. **3**, the computing environment may be a multimedia console **100**, such as a gaming console. As further shown in FIG. **3**, the multimedia console **100** has a central processing unit (CPU) **101** having a level 1 cache **102**, a level 2 cache **104**, and a flash ROM (Read Only Memory) **106**. The level 1 cache **102** and a level 2 cache **104** temporarily store data and hence reduce the number of memory access cycles, thereby improving processing speed and throughput. The CPU **101** may be provided having more than one core, and thus, additional level 1 and level 2 caches **102** and **104**. The flash ROM **106** may store executable code that is loaded during an initial phase of a boot process when the multimedia console **100** is powered ON.

A graphics processing unit (GPU) **108** and a video encoder/video codec (coder/decoder) **114** form a video processing pipeline for high speed and high resolution graphics processing. Data is carried from the graphics processing unit **108** to the video encoder/video codec **114** via a bus. The video processing pipeline outputs data to an A/V (audio/video) port **140** for transmission to a television or other display. A memory controller **110** is connected to the GPU **108** to facilitate processor access to various types of memory **112**, such as, but not limited to, a RAM (Random Access Memory).

The multimedia console **100** includes an I/O controller **120**, a system management controller **122**, an audio processing unit **123**, a network interface controller **124**, a first USB host controller **126**, a second USB controller **128** and a front panel I/O subassembly **130** that are preferably implemented on a module **118**. The USB controllers **126** and **128** serve as hosts for peripheral controllers **142(1)-142(2)**, a wireless adapter **148**, and an external memory device **146** (e.g., flash memory, external CD/DVD ROM drive, removable media, etc.). The network interface **124** and/or wireless adapter **148** provide access to a network (e.g., the Internet, home network, etc.) and may be any of a wide variety of various wired or wireless adapter components including an Ethernet card, a modem, a Bluetooth module, a cable modem, and the like.

System memory **143** is provided to store application data that is loaded during the boot process. A media drive **144** is provided and may comprise a DVD/CD drive, hard drive, or other removable media drive, etc. The media drive **144** may be internal or external to the multimedia console **100**. Application data may be accessed via the media drive **144** for execution, playback, etc. by the multimedia console **100**. The media drive **144** is connected to the I/O controller **120** via a bus, such as a Serial ATA bus or other high speed connection (e.g., IEEE 1394).

The system management controller **122** provides a variety of service functions related to assuring availability of the multimedia console **100**. The audio processing unit **123** and an audio codec **132** form a corresponding audio processing pipeline with high fidelity and stereo processing. Audio data is carried between the audio processing unit **123** and the audio codec **132** via a communication link. The audio processing pipeline outputs data to the A/V port **140** for reproduction by an external audio player or device having audio capabilities.

The front panel I/O subassembly **130** supports the functionality of the power button **150** and the eject button **152**, as well as any LEDs (light emitting diodes) or other indicators exposed on the outer surface of the multimedia console **100**. A system power supply module **136** provides power to the components of the multimedia console **100**. A fan **138** cools the circuitry within the multimedia console **100**.

The CPU **101**, GPU **108**, memory controller **110**, and various other components within the multimedia console **100** are interconnected via one or more buses, including serial and parallel buses, a memory bus, a peripheral bus, and a processor or local bus using any of a variety of bus architectures. By way of example, such architectures can include a Peripheral Component Interconnects (PCI) bus, PCI-Express bus, etc.

When the multimedia console **100** is powered ON, application data may be loaded from the system memory **143** into memory **112** and/or caches **102**, **104** and executed on the CPU **101**. The application may present a graphical user interface that provides a consistent user experience when navigating to different media types available on the multimedia console **100**. In operation, applications and/or other media contained within the media drive **144** may be launched or played from the media drive **144** to provide additional functionalities to the multimedia console **100**.

The multimedia console **100** may be operated as a standalone system by simply connecting the system to a television or other display. In this standalone mode, the multimedia console **100** allows one or more users to interact with the system, watch movies, or listen to music. However, with the integration of broadband connectivity made available through the network interface **124** or the wireless adapter **148**, the multimedia console **100** may further be operated as a participant in a larger network community.

When the multimedia console **100** is powered ON, a set amount of hardware resources are reserved for system use by the multimedia console operating system. These resources may include a reservation of memory (e.g., 16 MB), CPU and GPU cycles (e.g., 5%), networking bandwidth (e.g., 8 kbs), etc. Because these resources are reserved at system boot time, the reserved resources do not exist from the application's view.

In particular, the memory reservation preferably is large enough to contain the launch kernel, concurrent system applications and drivers. The CPU reservation is preferably constant such that if the reserved CPU usage is not used by the system applications, an idle thread will consume any unused cycles.

With regard to the GPU reservation, lightweight messages generated by the system applications (e.g., popups) are displayed by using a GPU interrupt to schedule code to render popup into an overlay. The amount of memory required for an overlay depends on the overlay area size and the overlay preferably scales with screen resolution. Where a full user interface is used by the concurrent system application, it is preferable to use a resolution independent of application resolution. A scaler may be used to set this resolution such that the need to change frequency and cause a TV resynch is eliminated.

After the multimedia console **100** boots and system resources are reserved, concurrent system applications execute to provide system functionalities. The system functionalities are encapsulated in a set of system applications that execute within the reserved system resources described above. The operating system kernel identifies threads that are system application threads versus gaming application threads. The system applications are preferably scheduled to run on the CPU **101** at predetermined times and intervals in order to provide a consistent system resource view to the application. The scheduling is to minimize cache disruption for the gaming application running on the console.

When a concurrent system application requires audio, audio processing is scheduled asynchronously to the gaming application due to time sensitivity. A multimedia console application manager (described below) controls the gaming application audio level (e.g., mute, attenuate) when system applications are active.

Input devices (e.g., controllers **142(1)** and **142(2)**) are shared by gaming applications and system applications. The input devices are not reserved resources, but are to be switched between system applications and the gaming application such that each will have a focus of the device. The application manager preferably controls the switching of input stream, without knowledge the gaming application's knowledge and a driver maintains state information regarding focus switches. The cameras **26**, **28** and capture device **20** may define additional input devices for the console **100**.

FIG. **4** illustrates another example embodiment of a computing environment **220** that may be used to implement the computing environment **12** shown in FIGS. **1A-2** used to interpret one or more gestures in a target recognition, analysis, and tracking system. The computing system environment **220** is only one example of a suitable computing environment and is not intended to suggest any limitation as to the scope of use or functionality of the presently disclosed subject matter. Neither should the computing environment **220** be interpreted as having any dependency or requirement relating to any one or combination of components illustrated in the exemplary operating environment **220**. In some embodiments the various depicted computing elements may include circuitry configured to instantiate specific aspects of the present disclosure. For example, the term circuitry used in the disclosure can include specialized hardware components configured to perform function(s) by firmware or switches. In other examples embodiments the term circuitry can include a general purpose processing unit, memory, etc., configured by software instructions that embody logic operable to perform function(s). In example embodiments where circuitry includes a combination of hardware and software, an implementer may write source code embodying logic and the source code can be compiled into machine readable code that can be processed by the general purpose processing unit. Since one skilled in the art can appreciate that the state of the art has evolved to a point where there is little difference between hardware, software, or a combination of hardware/software, the selection of hardware versus software to effectuate specific functions is a design choice left to an implementer. More specifically, one of skill in the art can appreciate that a software process can be transformed into an equivalent hardware structure, and a hardware structure can itself be transformed into an equivalent software process. Thus, the selection of a hardware implementation versus a software implementation is one of design choice and left to the implementer.

In FIG. **4**, the computing environment **220** comprises a computer **241**, which typically includes a variety of computer readable media. Computer readable media can be any available media that can be accessed by computer **241** and includes both volatile and nonvolatile media, removable and non-removable media. The system memory **222** includes computer storage media in the form of volatile and/or nonvolatile memory such as read only memory (ROM) **223** and random access memory (RAM) **260**. A basic input/output system **224** (BIOS), containing the basic routines that help to transfer information between elements within computer **241**, such as during start-up, is typically stored in ROM **223**. RAM **260** typically contains data and/or program modules that are immediately accessible to and/or presently being operated on by processing unit **259**. By way of example, and not limitation, FIG. **4** illustrates operating system **225**, application programs **226**, other program modules **227**, and program data **228**.

The computer **241** may also include other removable/non-removable, volatile/nonvolatile computer storage media. By way of example only, FIG. **4** illustrates a hard disk drive **238** that reads from or writes to non-removable, nonvolatile magnetic media, a magnetic disk drive **239** that reads from or writes to a removable, nonvolatile magnetic disk **254**, and an optical disk drive **240** that reads from or writes to a removable, nonvolatile optical disk **253** such as a CD ROM or other optical media. Other removable/non-removable, volatile/nonvolatile computer storage media that can be used in the exemplary operating environment include, but are not limited to, magnetic tape cassettes, flash memory cards, digital versatile disks, digital video tape, solid state RAM, solid state ROM, and the like. The hard disk drive **238** is typically connected to the system bus **221** through an non-removable memory interface such as interface **234**, and magnetic disk drive **239** and optical disk drive **240** are typically connected to the system bus **221** by a removable memory interface, such as interface **235**.

The drives and their associated computer storage media discussed above and illustrated in FIG. **4**, provide storage of computer readable instructions, data structures, program modules and other data for the computer **241**. In FIG. **4**, for example, hard disk drive **238** is illustrated as storing operating system **258**, application programs **257**, other program modules **256**, and program data **255**. Note that these components can either be the same as or different from operating system **225**, application programs **226**, other program modules **227**, and program data **228**. Operating system **258**, application programs **257**, other program modules **256**, and program data **255** are given different numbers here to illustrate that, at a minimum, they are different copies. A user may enter commands and information into the computer **241** through input devices such as a keyboard **251** and pointing device **252**, commonly referred to as a mouse, trackball or touch pad. Other input devices (not shown) may include a microphone, joystick, game pad, satellite dish, scanner, or the like. These and other input devices are often connected to the processing unit **259** through a user input interface **236** that is coupled to the system bus, but may be connected by other interface and bus structures, such as a parallel port, game port or a universal serial bus (USB). The cameras **26**, **28** and capture device **20** may define additional input devices for the console **100**. A monitor **242** or other type of display device is also connected to the system bus **221** via an interface, such as a video interface **232**. In addition to the monitor, computers may also include other peripheral output devices such as speakers **244** and printer **243**, which may be connected through a output peripheral interface **233**.

The computer **241** may operate in a networked environment using logical connections to one or more remote computers, such as a remote computer **246**. The remote computer **246** may be a personal computer, a server, a router, a network PC, a peer device or other common network node, and typically includes many or all of the elements described above relative to the computer **241**, although only a memory storage device **247** has been illustrated in FIG. **4**. The logical connections depicted in FIG. **2** include a local area network (LAN) **245** and a wide area network (WAN) **249**, but may also include other networks. Such networking environments are commonplace in offices, enterprise-wide computer networks, intranets and the Internet.

When used in a LAN networking environment, the computer **241** is connected to the LAN **245** through a network interface or adapter **237**. When used in a WAN networking environment, the computer **241** typically includes a modem **250** or other means for establishing communications over the WAN **249**, such as the Internet. The modem **250**, which may be internal or external, may be connected to the system bus **221** via the user input interface **236**, or other appropriate mechanism. In a networked environment, program modules depicted relative to the computer **241**, or portions thereof, may be stored in the remote memory storage device. By way of example, and not limitation, FIG. **4** illustrates remote application programs **248** as residing on memory device **247**. It will be appreciated that the network connections shown are exemplary and other means of establishing a communications link between the computers may be used.

The computer readable storage media described above may have stored thereon instructions for scanning a human in a captured scene. The computer executable instructions may comprise instructions for receiving a depth image of a physical space, wherein the depth image includes data representative of a gesture, and rendering visual assistance representing instructional gesture data for the gesture. The computer readable storage media described above may have stored thereon instructions for determining whether to provide instructional data. The instructions may comprise receiving image data for a scene, wherein the image data includes data representative of a gesture, comparing the data representative of the gesture to at least one output of a gesture filter, detecting a variation between the data representative of the gesture and the at least one output of the gesture filter, wherein the variation is indicative of a failure in an execution of the gesture; and based on the variation, determining whether to provide instructional gesture data.

FIG. **5**A depicts an example skeletal mapping of a user that may be generated from the capture device **20**. In this embodiment, a variety of joints and bones are identified: each hand **502**, each forearm **504**, each elbow **506**, each bicep **508**, each shoulder **510**, each hip **512**, each thigh **514**, each knee **516**, each foreleg **518**, each foot **520**, the head **522**, the torso **524**, the top **526** and bottom **528** of the spine, and the waist **530**. Where more points are tracked, additional features may be identified, such as the bones and joints of the fingers or toes, or individual features of the face, such as the nose and eyes.

Through moving his body, a user may create gestures. A gesture comprises a motion or pose by a user that may be captured as image data and parsed for meaning A gesture may be dynamic, comprising a motion, such as mimicking throwing a ball. A gesture may be a static pose, such as holding one's crossed forearms **504** in front of his torso **524**. A gesture may be a single movement (e.g., a jump) or a continuous gesture (e.g., driving), and may be short in duration or long in duration (e.g., driving for **20** minutes). A gesture may also incorporate props, such as by swinging a mock sword. A gesture may comprise more than one body part, such as clapping the hands **502** together, or a subtler motion, such as pursing one's lips.

A user's gestures may be used for input in a general computing context. For instance, various motions of the hands **502** or other body parts may correspond to common system wide tasks such as navigate up or down in a hierarchical list, open a file, close a file, and save a file. For instance, a user may hold his hand with the fingers pointing up and the palm facing the capture device **20**. He may then close his fingers towards the palm to make a fist, and this could be a gesture that indicates that the focused window in a window-based user-interface computing environment should be closed. Gestures may also be used in a video-game-specific context, depending on the game. For instance, with a driving game, various motions of the hands **502** and feet **520** may correspond to steering a vehicle in a direction, shifting gears, accelerating, and breaking Thus, a gesture may indicate a wide variety of motions that map to a displayed user representation, and in a wide variety of applications, such as video games, text editors, word processing, data management, etc.

A user may generate a gesture that corresponds to walking or running, by walking or running in place himself. For example, the user may alternately lift and drop each leg **512**-**520** to mimic walking without moving. The system may parse this gesture by analyzing each hip **512** and each thigh **514**. A step may be recognized when one hip-thigh angle (as measured relative to a vertical line, wherein a standing leg has a hip-thigh angle of 0°, and a forward horizontally extended leg has a hip-thigh angle of 90°) exceeds a certain threshold relative to the other thigh. A walk or run may be recognized after some number of consecutive steps by alternating legs.

The time between the two most recent steps may be thought of as a period. After some number of periods where that threshold angle is not met, the system may determine that the walk or running gesture has ceased.

Given a "walk or run" gesture, an application may set values for parameters associated with this gesture. These parameters may include the above threshold angle, the number of steps required to initiate a walk or run gesture, a number of periods where no step occurs to end the gesture, and a threshold period that determines whether the gesture is a walk or a run. A fast period may correspond to a run, as the user will be moving his legs quickly, and a slower period may correspond to a walk.

A gesture may be associated with a set of default parameters at first that the application may override with its own parameters. In this scenario, an application is not forced to provide parameters, but may instead use a set of default parameters that allow the gesture to be recognized in the absence of application-defined parameters. Information related to the gesture may be stored for purposes of pre-canned gesture animation.

There are a variety of outputs that may be associated with the gesture. There may be a baseline "yes or no" as to whether a gesture is occurring. There also may be a confidence level, which corresponds to the likelihood that the user's tracked movement corresponds to the gesture. This could be a linear scale that ranges over floating point numbers between **0** and **1**, inclusive. Wherein an application receiving this gesture information cannot accept false-positives as input, it may use only those recognized gestures that have a high confidence level, such as at least 0.95. Where an application must recognize every instance of the gesture, even at the cost of false-positives, it may use gestures that have at least a much lower confidence level, such as those merely greater than 0.2. The gesture may have an output for the time between the two most recent steps, and where only a first step has been registered, this may be set to a reserved value, such as −1 (since the time between any two steps must be positive). The gesture may also have an output for the highest thigh angle reached during the most recent step.

Another exemplary gesture is a "heel lift jump." In this, a user may create the gesture by raising his heels off the ground, but keeping his toes planted. Alternatively, the user may jump into the air where his feet **520** leave the ground entirely. The system may parse the skeleton for this gesture by analyzing the angle relation of the shoulders **510**, hips **512** and knees **516** to see if they are in a position of alignment equal to standing up straight. Then these points and upper **526** and lower **528** spine points may be monitored for any upward acceleration. A sufficient combination of acceleration may trigger a jump gesture. A sufficient combination of acceleration with a particular gesture may satisfy the parameters of a transition point.

Given this "heel lift jump" gesture, an application may set values for parameters associated with this gesture. The parameters may include the above acceleration threshold, which determines how fast some combination of the user's shoulders **510**, hips **512** and knees **516** must move upward to trigger the gesture, as well as a maximum angle of alignment between the shoulders **510**, hips **512** and knees **516** at which a jump may still be triggered. The outputs may comprise a confidence level, as well as the user's body angle at the time of the jump.

Setting parameters for a gesture based on the particulars of the application that will receive the gesture is important in accurately identifying gestures. Properly identifying gestures and the intent of a user greatly helps in creating a positive user experience.

An application may set values for parameters associated with various transition points to identify the points at which to use pre-canned animations. Transition points may be defined by various parameters, such as the identification of a particular gesture, a velocity, an angle of a target or object, or any combination thereof If a transition point is defined at least in part by the identification of a particular gesture, then properly identifying gestures assists to increase the confidence level that the parameters of a transition point have been met.

Another parameter to a gesture may be a distance moved. Where a user's gestures control the actions of an avatar in a virtual environment, that avatar may be arm's length from a ball. If the user wishes to interact with the ball and grab it, this may require the user to extend his arm **502-510** to full length while making the grab gesture. In this situation, a similar grab gesture where the user only partially extends his arm **502-510** may not achieve the result of interacting with the ball. Likewise, a parameter of a transition point could be the identification of the grab gesture, where if the user only partially extends his arm **502-510**, thereby not achieving the result of interacting with the ball, the user's gesture also will not meet the parameters of the transition point.

A gesture or a portion thereof may have as a parameter a volume of space in which it must occur. This volume of space may typically be expressed in relation to the body where a gesture comprises body movement. For instance, a football throwing gesture for a right-handed user may be recognized only in the volume of space no lower than the right shoulder **510***a*, and on the same side of the head **522** as the throwing arm **502***a*-**310***a*. It may not be necessary to define all bounds of a volume, such as with this throwing gesture, where an outer bound away from the body is left undefined, and the volume extends out indefinitely, or to the edge of scene that is being monitored.

FIG. **5**B provides further details of one exemplary embodiment of the gesture recognizer engine **190** of FIG. **2**. As shown, the gesture recognizer engine **190** may comprise at least one filter **518** to determine a gesture or gestures. A filter **518** comprises information defining a gesture **526** (hereinafter referred to as a "gesture"), and may comprise at least one parameter **528**, or metadata, for that gesture. For instance, a throw, which comprises motion of one of the hands from behind the rear of the body to past the front of the body, may be implemented as a gesture **526** comprising information representing the movement of one of the hands of the user from behind the rear of the body to past the front of the body, as that movement would be captured by the depth camera. Parameters **528** may then be set for that gesture **526**. Where the gesture **526** is a throw, a parameter **528** may be a threshold velocity that the hand has to reach, a distance the hand must travel (either absolute, or relative to the size of the user as a whole), and a confidence rating by the recognizer engine that the gesture occurred. These parameters **528** for the gesture **526** may vary between applications, between contexts of a single application, or within one context of one application over time.

Filters may be modular or interchangeable. In an embodiment, a filter has a number of inputs, each of those inputs having a type, and a number of outputs, each of those outputs having a type. In this situation, a first filter may be replaced with a second filter that has the same number and types of inputs and outputs as the first filter without altering any other aspect of the recognizer engine architecture. For instance, there may be a first filter for driving that takes as input skeletal data and outputs a confidence that the gesture associated with the filter is occurring and an angle of steering. Where one wishes to substitute this first driving filter with a second driving filter—perhaps because the second driving filter is more efficient and requires fewer processing resources—one may do so by simply replacing the first filter with the second filter so long as the second filter has those same inputs and outputs—one input of skeletal data type, and two outputs of confidence type and angle type.

A filter need not have a parameter. For instance, a "user height" filter that returns the user's height may not allow for any parameters that may be tuned. An alternate "user height" filter may have tunable parameters—such as to whether to account for a user's footwear, hairstyle, headwear and posture in determining the user's height.

Inputs to a filter may comprise things such as joint data about a user's joint position, like angles formed by the bones that meet at the joint, RGB color data from the scene, and the rate of change of an aspect of the user. Outputs from a filter may comprise things such as the confidence that a given gesture is being made, the speed at which a gesture motion is made, and a time at which a gesture motion is made.

A context may be a cultural context, and it may be an environmental context. A cultural context refers to the culture of a user using a system. Different cultures may use similar gestures to impart markedly different meanings. For instance, an American user who wishes to tell another user to "look" or "use his eyes" may put his index finger on his head close to the distal side of his eye. However, to an Italian user, this gesture may be interpreted as a reference to the mafia.

Similarly, there may be different contexts among different environments of a single application. Take a first-person shooter game that involves operating a motor vehicle. While the user is on foot, making a first with the fingers towards the ground and extending the first in front and away from the body may represent a punching gesture. While the user is in the driving context, that same motion may represent a "gear shifting" gesture. There may also be one or more menu environments, where the user can save his game, select among his character's equipment or perform similar actions that do not comprise direct game-play. In that environment, this same gesture may have a third meaning, such as to select something or to advance to another screen.

Filters can be run side by side, and multiple filters may look for the same things but different execution. Thus, the number of filters may increased depending on the permutation of motion that could define a gesture. For example, a curve ball may be an overhand gesture, but then, a player may prefer to throw underhand if they are successful that way.

The gesture recognizer engine **190** may have a base recognizer engine **516** that provides functionality to a gesture filter **518**. In an embodiment, the functionality that the recognizer engine **516** implements includes an input-over-time archive that tracks recognized gestures and other input, a Hidden Markov Model implementation (where the modeled system is assumed to be a Markov process—one where a present state encapsulates any past state information necessary to determine a future state, so no other past state information must be maintained for this purpose—with unknown parameters, and hidden parameters are determined from the observable data), as well as other functionality required to solve particular instances of gesture recognition.

Filters **518** are loaded and implemented on top of the base recognizer engine **516** and can utilize services provided by the engine **516** to all filters **518**. In an embodiment, the base recognizer engine **516** processes received data to determine whether it meets the requirements of any filter **518**. Since these provided services, such as parsing the input, are provided once by the base recognizer engine **516** rather than by each filter **518**, such a service need only be processed once in a period of time as opposed to once per filter **518** for that period, so the processing required to determine gestures is reduced.

An application may use the filters **518** provided by the recognizer engine **190**, or it may provide its own filter **518**, which plugs in to the base recognizer engine **516**. In an embodiment, all filters **518** have a common interface to enable this plug-in characteristic. Further, all filters **518** may utilize parameters **528**, so a single gesture tool as described below may be used to debug and tune the entire filter system **518**.

These parameters **528** may be tuned for an application or a context of an application by a gesture tool **520**. In an embodiment, the gesture tool **520** comprises a plurality of sliders **522**, each slider **522** corresponding to a parameter **528**, as well as a pictoral representation of a body **524**. As a parameter **528** is adjusted with a corresponding slider **522**, the body **524** may demonstrate both actions that would be recognized as the gesture with those parameters **528** and actions that would not be recognized as the gesture with those parameters **528**, identified as such. This visualization of the parameters **528** of gestures provides an effective means to both debug and fine tune a gesture.

The example of an application executing on the computing environment shown in FIGS. **6**A-**6**C is a boxing game that a user may be playing. FIGS. **6**A-**6**C represent a user's punching gesture in the physical space, **62***a*, **62***b*, **62***c*, where the visual representation of the user, **64***a*, **64***b*, **64***c* maps to the user's motions in the physical space. Each of FIGS. **6**A-**6**C illustrate the user's position in the physical space at three discrete points of time during the user's punching gesture, **62***a*, **62***b*, **62***c* and an example of the visual representation of the user, **64***a*, **64***b*, **64***c*, displayed in the application space. The rate that frames of image data are captured and displayed determines the level of continuity of the displayed motion of the visual representation. Though additional frames of image data may be captured and displayed, the frames depicted in FIGS. **6**A-**6**C are selected for exemplary purposes.

The capture device **20** may capture, analyze, and track the user's motions made in the physical space, such as the user's punching gesture **62***a*, **62***b*, **62***c*. According to an example embodiment, the capture device **20** may be configured to capture video with depth information including a depth image of a scene. The capture device **20** may provide the depth information and images captured and a skeletal model that may be generated by the capture device **20** for display by the audiovisual component **16**. The user may view the image or visual representation of the user, **64***a*, on an audiovisual device **16**, such as a television screen shown in FIG. **6**D.

The audiovisual device **16** may provide a visual representation of a player avatar, **64***a*, **64***b*, **64***c*, that the user may control with his or her movements. The user's motions may map to the visual representation in the application space to perform one or more controls or actions within the application. For example, the user may be tracked using the capture device **20** such that gestures of user **18** may be interpreted as controls that may affect the application being executed by the computer environment. In the boxing game application, the user's gesture in the physical space in the form of a punching motion, **62***a*, **62***b*, **62***c*, controls the gestures made by the visual representation, **64***a*, **64***b*, **64***c*, causing a punch to occur in the game space. Thus, according to an example embodiment, a computer environment and the capture device **20** of the target recognition, analysis, and tracking system **10** may be used to recognize and analyze the punch of the user **18** in physical space such that the punch may be interpreted as a game control of the player avatar **40** in the game space. The visual representation may be mapped to the user's gestures and displayed in real-time with respect to the execution of the gesture in the physical space.

It may be desirable in some situations to provide visual assistance representing instructional gesture data to teach a user how to gesture properly. Instructional gesture data can teach a user how to gesture properly to control the executing application. In an example embodiment, the computing system or the executing application may identify errors in a user's gesture and provide instructional gesture data to highlight the errors. In another example embodiment, the user selects a training session or enters into training mode to learn how to gesture properly.

FIGS. **7**A-C depict example split-screen screenshots for replaying a user's gestures as an avatar, with instructional gesture data displayed side-by-side with the avatar. The left side of each split-screen renders the visual representation of a user's gestures at the three discrete points of time during the user's punching gesture, **64***a*, **64***b*, **64***c*, as shown in FIGS. **6**A-**6**C. The right side of each split-screen renders an example embodiment of visual assistance representing instructional gesture data, **74***a*, **74***b*, **74***c*, corresponding to each of the frames of image data **64***a*, **64***b*, **64***c*. FIG. **7**D depicts the display portion of system **10** from FIGS. **1**A and **1**B, showing an example embodiment for displaying the split screen. In this example, the left side of each of FIGS. **7**A-**7**C corresponds to a snapshot or frame of image data as captured by a depth camera, a parallel RGB camera, or images combined from both cameras. On the right side of the split-screen, the system displays visual assistance that highlights an error in the user's gesture.

The visual assistance can be a demonstration of proper motion. For example, the user could select a training session for punches and the system could initiate an interactive training session that teaches the user the motion for a particular punch. The system can display the user's motion, live or replayed, along with the visual assistance, highlighting any errors in the user's motion. Various display techniques to highlight the errors in the user's gestures. The assistance can portray the delta between the user's actual position and the ideal position. For example, the arrows in FIGS. **7**B and **7**C point to a part of the avatar's body, **64***a*, **64***b*, **64***c*, that represents the user's positioning in the physical space, exemplifying how the user's positioning varies from an ideal gesture position at that point in time, **74***a*, **74***b*, **74***c*.

The system may provide visual assistance for training purposes to demonstrate the appropriate motions to control the system or an executing application. The training may be part of a training mode that the user actively selects to enter. The user may also request training, such as the first time the user executes an application. Various events may trigger the display of visual assistance for gesture demonstration. The system may detect an error in the user's motion or a deviation from an expected motion. The system may identify areas of a user's positioning throughout the gesture that could be improved to achieve higher success in the executing application. A user's gesture may not be one that corresponds to a recognized gesture, indicating that the user is unfamiliar with the applicable gestures. The system may predict the user's intended gesture and provide an option for training the user to properly make that gesture. The system may recognize an inexperienced user and offer training Any of these events may trigger the display of visual assistance comprising instructional gesture data.

The system or application may comprise a training mode and an execution mode. The training mode may be entered into automatically as a result of a trigger, such as those described above. For example, if the user **18** is throwing a punch in the physical space that does not correspond to a recognized gesture, the system **10** may interrupt the application, enter into a training mode, and provide visual assistance that demonstrates appropriate gestures to the user.

The system may identify an error in the user's motion by evaluating the user's position in a single frame of captured data or over a series of frames. For example, the system may recognize a user's gesture as an uppercut punching motion, identified by movement within certain volumes of space with respect to the user. The system may also identify that, in certain frames of image data, the user is not moving his arm properly in the physical space or that changes in the user's motion could give more success in the boxing game.

The system may identify errors based on the certain parameters of the user's measured gesture, such as a deviation from an ideal velocity range or if the user's measured gesture falls outside the expected volumes of space. For example, a baseball application may direct the user to make an overhand throwing motion to throw a ball to a batter. A depth camera or an RGB camera may identify aspects of the user's motions in the physical space, and a gesture filter **191** may identify the motion to be in a class of throwing gestures. The parameters for various classes of throwing gestures may be distinguished based on the volume of space monitored around a user's head. An overhand throw may be the volume of space in front and behind the user's head but above the user's throwing shoulder. An underhand throw may be defined by a volume of space in front and below a user's waist, the volume extending between the shoulder and the user's waist. The gesture filter may identify an overhand throw based on parameters of the user's motion in the physical space. The gesture filter may expect an overhand throw (or an attempted overhand throw) due to the point of execution in the application (e.g., the user is at a point in a baseball application where the user is directed to throw a ball to a batter). Deviations from the filter parameters or the failure to meet threshold levels of acceptance may trigger the display of visual assistance.

The display of the visual assistance comprising instructional gesture data can take any suitable form. The instructional gesture data, **74***a*, **74***b*, **74***c*, in this embodiment, is displayed as a stick figure representation, but it is contemplated that the visual representation may take on any suitable representation. For example, arrows or highlighted sections of the visual representation of the user may indicate proper gesturing, as shown in FIGS. **7**A-**7**D. The display could be side-by-side representations of the user's gesture and the ideal gesture, also shown in FIGS. **7**A-**7**D. The visual assistance could be in the form of replayed motion (at the rate of capture, slowed, fast, etc) or displayed in real-time. As shown in FIG. **8**A, an image representing the instructional gesture data could be ghosted or superimposed over the visual representation.

The left side of each of FIGS. **7**A-**7**C may correspond directly to a snapshot or frame of image data as captured by a depth camera and/or an RGB camera. The selected frames of image data may be replayed at any speed and can be viewed in a continuous replay of motion or one at a time as separate screen captures. The frames of image data may be replayed at a speed that corresponds to frames per second rate of capture. Instructional gesture data, such as that shown on the right hand side of each of FIGS. **7**A-**7**C, may correspond to the frames of image data shown on the left side. Any number of frames of image data may be captured and any number of corresponding frames of instructional gesture data may be generated for any given gesture. Thus, additional frames of image data and corresponding instructional gesture data may be available. The user can pause, scroll, view, zoom, etc the display of visual assistance.

The screenshot of image data on the left side of FIG. **7**B depicts the user's gesture **64***b* at a second point in time. On the right side of the split-screen, the system displays visual assistance that highlights an error in the user's gesture. Displaying the visual representation of the user's gesture side by side with instructional gesture data that highlights an error in the user's gesture may assist the user to correct his or her motion in the physical space. For example, FIG. **7**B highlights the error in the user's gesture by pointing with an arrow to the position of the user's arm. In this example, the visual assistance points to a better position for the user's arm at that point in the gesture to teach the user how to properly make an uppercut motion or to be more successful in the boxing game. Similarly, FIG. **7**C depicts a screenshot of the user's image data, pointing out that at that point in the uppercut punching gesture, the user will achieve better success if he or she completes the motion with his arm in a higher position. The side by side depiction can demonstrate the delta between the user's actual position and the ideal position.

The system can display the user's motion along with live or real-time visual assistance to highlight the errors in the user's motion. Thus, instead of the screenshots of image data in FIGS. **7**A-**7**C being a replay of the user's gesture, the user may gesture in the physical space and view live visual assistance on the right side of each split-screen. For example, the instructional gesture data may be provided in an interactive training session. The training session may demonstrate the proper positioning at discrete points in time throughout the uppercut punching gesture. At each discrete point, the user can gesture in the physical space and observe, in real time, the user's gesture as it compares to the visual assistance showing the proper gesture position. The user can cycle through various points in time, learning and performing the proper gesture at each point and receiving real-time visual assistance regarding the ideal position that the user should be in at that time. The user can correct his or her motion frame by frame.

While FIGS. **7**A-**7**C depict a split-screen display of the visual representation of the user and the instructional gesture data, it is contemplated that the instructional gesture data may be provided in any suitable form. For example, rather than a split screen, just the left side of the split-screen in FIGS. **7**A-**7**C may be displayed to highlight the errors in the user's gesture. The errors are highlighted, in this example, as arrows that point to the deviation of the user's gesture. In another example, or combined with another form of instructional gesture data, auditory assistance such as a voice-over could verbalize the errors or possible corrections for the user.

The instructional gesture data may indicate a proper alignment of the user in the physical space to inform the user how to move into proper view of the capture device's field of capture. For example, if a particular gesture filter is failing to provide a confident result for a gesture because the motion of a limb captured by the capture device is moving out of view of the capture device's field of capture, the instructional gesture data may comprise a set of training data or assistance that informs the user that they need to move in the physical space for better alignment with the capture device. For example, a voice-over may say "please step to your left," or the visual representation of the user on the screen, such as that shown by **64***a*, **64***b*, and **64***c*, may only show a portion of the visual representation on the screen, indicating that the user needs to realign himself or herself in the physical space.

FIGS. **8**A and **8**B depict additional examples of providing instructional gesture data to a user. In FIG. **8**A, a representation of a corrected gesture animation, shown as a stick figure representation, is superimposed or overlaid over the user's visual representation. Thus, an indication of proper motion overlaps the user's image data. The user can replay his or her motion and view the instructional gesture data that overlaps the visual representation of the user's gesture. The user can then observe the delta between the user's actual position and the ideal position. An arrow is just one example for providing a visual representation of the delta between the user's arm position and the visual assistance. Highlighting the delta allows the user to determine what modifications could improve the gesture in the physical space.

The training data may be displayed as an overlay, as shown in FIG. **8**A, during the execution of the application, such as a game that is in progress. Thus, it may not be necessary to interrupt the game to go into a separate training mode. Instructional gesture data may comprise hints or small suggestions to the user's motion, and the hints may be expressed as an overlay in the game such that the game play continues uninterrupted while providing the instructional gesture data.

The example display of visual assistance in FIG. **8**B is a visual representation of the instructional gesture data that includes a demonstration of the gesture. The demonstration may be broken up into phases or be a continuous video clip. The visual representation of the instructional gesture data may be in any suitable form, such as in the form of a skeletal representation, a ghosted image, or a player avatar.

The application may trigger entry into a training mode as a result of a selection of a training mode by the user, a detection of user gesture error, the initiation of an application, or the like. For example, upon detection of an error in the user's gesture, an optional entry into training mode may be offered to the user. The system may not recognize the gesture made by the user and offer suggestions for training based on predictions of the user's intended motion. The system may recognize the gesture and offer suggestions as to a better gesture applicable to the application at that point in time, or offer suggestions for training to better gesture the gesture made by the user for more success in the application.

FIG. **9** depicts an example of options, **902***a*, **902***b*, **902***c*, **902***d*, that the system may display to a user in a boxing game. The display device **16** can display options for the predicted gesture(s), and the user can select an option to receive training to properly perform or improve performance of the gesture. The possible gestures may be any gesture applicable to a gesture-based system, an executing application, a plug-in with supplemental gestures, or the like. The options shown in FIG. **9**, **902***a*, **902***b*, **902***c*, **902***d*, are applicable to the executing application, a boxing game.

In this example, the user's gesture in the physical space is identified as a punching gesture. As described above, a gestures recognition engine **190** may include a collection of gesture filters **191**. Each filter **191** may comprise information defining a gesture along with parameters, or metadata, for that gesture. The data captured by the cameras **26**, **28** and device **20** in the form of the skeletal model and movements associated with it may be compared to the gesture filters in the gesture library **190** to identify when a user has performed one or more gestures.

In an example embodiment, the system gathers and stores history data for a particular user, such as storing history data in a user profile. The system could adapt the filter parameters and the threshold level for the user based on this history data. For example, the filter parameters for the volume of space that are used to identify the gesture as an overhand throw may be set to default values in accordance with research or simulation data. A user's hand, however, may tend to be a distance further from the user's head than is common, and therefore outside the bounds of the volume of space set for an overhand throw. Initially, the variation may be indicative of a failure in the execution of the gesture, triggering a display or options for entering a training mode to learn how to execute the gesture. Over time, the system may gather data with respect to the user and modify the filter parameters to accommodate for the user's tendencies. For example, the parameters that define volume of space could be modified to shift the volume of space to more closely align with the user's body position. A threshold level of acceptance could also vary accordingly

The training session may be interactive such that the user's actual motion is evaluated, highlighted, corrected, etc, such as in the manner described in FIGS. **7**A-**7**C. The visual assistance may be a demonstration of proper gestures applicable to an application that a user can practice in the physical space without a visual representation of the user's motion. FIG. **8**B depicts an example of the demonstration of a proper gesture via separate frames of motion. The demonstration may highlight positions that the user's should place his or her body to properly perform the gesture. The demonstration may be irrespective of the user's gestures. Alternately, the visual assistance may be a result of an evaluation of the user's gestures, where the visual assistance pinpoints specific areas for improvement specific to the user.

Other techniques for displaying the visual assistance are possible. For example, a visual representation of the instructional gesture data may be on a portion of the display space, wherein the portion is smaller than a total display space. The visual assistance providing instructional gesture data may comprise a coach, such as a user-created coach, a human coach, a prerecorded coach, or the like. The coach may pop-up as a video feed. The coach may provide verbal instructions that correspond to the demonstrated gesture. A user could learn a gesture, such as how to throw a baseball, by accessing a training program. From the basics, the coach could walk the user through the gestures that make up a throw. The user may select a specific coach, such as from a collection of avatars that represent real or invented personas. Different personalities could be used, such as a famous baseball player. The representation of the coach may be prerecorded data displayed along with a demonstrated gesture. Alternately, the visual assistance may be a human coach, displayed live in real-time from another user. The visual assistance may be in the form of a voice-over or a live coach that provides gesture demonstration via a network.

FIG. **10** depicts an example of two users remotely connected and interacting through a boxing game application. The remote connection may be over a network, for example. The network may be managed by a host and may be a subscription-based system. Such a connection enables users to be remotely connected or networked such that multiple users can interact via their respective computing environments.

For example, consider first and second remote users executing a gaming application, playing as a team over a remote connection against other users. The first user may recognize that the second user is performing a certain motion incorrectly and is therefore causing failure in the game for the team. The first user may provide, in real-time, the demonstration of a gesture, **1002***a*, such that the second user can observe the visual assistance on the display in the second user's computing environment, **1002***b*. The second user's computing environment may receive information related to the demonstrated gesture and provide visual assistance to the second user. The visual assistance may be provided live to the second user, delayed only by the time it takes to transmit from the first user, and process and display the information to the second user. Suitable technology can be implemented such that transmission and processing times are fast, minimizing the delay of visual assistance to the second user based on the first user's live gesture demonstration.

The display of a visual representation of user #**1** to user #**2** in real-time may be a result of numerous triggers. For example, user #**1** may request instruction from user #**2**, user #**2** may recognize errors in user #**1**'s gestures, users may interact for the purpose of learning tactics from each other, etc. The users may pause the application and have an interactive training session. User #**1**'s computing environment may display a visual representation of user #**2**, simulating an in-person training session. User #**2** can communicate, display motion, etc, that is simulated to user #**2**.

FIG. **11**A depicts exemplary operational procedures for a gesture coach.

Operation **1102** depicts receiving data captured by a capture device **20**, the data corresponding to a user-performed gesture. The capture device may capture a scene that contains all of the user, such as from the floor to the ceiling and to the wall on each side of a room at the distance in which the user is located. The capture device may also capture a scene that contains only part of the user, such as the user from the abdomen up as he or she sits at a desk. The capture device may also capture an object controlled by the user, such as a prop camera that the user holds in his or her hand.

Operation **1104** depicts analyzing the data to produce an output corresponding to whether the data corresponds to a system-recognized gesture. In an embodiment, this analyzing may be performed with a filter **518** applied to the data by gesture recognizer engine **190**.

Operation **1106** depicts determining from the output that it is unlikely that the user correctly performed the system-recognized gesture. In an embodiment, the system-recognized gesture comprises a gesture corresponding to the filter.

In an embodiment, the output comprises a confidence level. In an embodiment, is unlikely that the user correctly performed the gesture corresponding to the filter when the confidence level is below a threshold. That threshold may be the level at which it is likely that the user correctly performed the gesture. There may be a difference between the threshold level above which it is likely that the user correctly performed the gesture and the threshold level below which it is unlikely that the user performed the gesture, with levels between those two thresholds being neither considered likely nor unlikely.

In an embodiment where the gesture filter comprises multiple outputs, it may be unlikely that the user correctly performed the gesture when at least one output corresponds to it being unlikely that the user correctly performed the gesture. For instance, a "automobile steering" filter may comprise outputs for the distance between the user's hands, the position of the user's hands relative to the rest of his body, and an angle at which the hands are tilted. It may be likely that the user is performing the steering gesture where he has his hands 12-18" apart, in front of his chest, and each hand displays a rotational angle off vertical that corresponds to the same steering angle. Where the user correctly spaces his hands and places them in front of his chest, yet rotates both hands outward, such that his left hand signifies steering to the left and his right hand signifies steering to the right, that only one of these parameters is not met may be sufficient to determine that it is unlikely that the user correctly performed the gesture.

Operation **1108** determining from the output that the user likely intended to perform the system-recognized gesture.

In an embodiment where a user must sustain a gesture, such as by holding the steering position for a prolonged period of time while the user steers, it may be determined that the user likely intended to perform the gesture where an output at least occasionally corresponds to that gesture being performed, but does not correspond to that gesture being performed for an extended period of time.

In an embodiment where the gesture filter comprises multiple outputs, it may be likely that the user intended to perform the gesture when at output corresponds to the user performing the gesture. For instance, given the "automobile steering" filter discussed above, it may be that the user has correct hand spacing, and his respective hand rotation angles correspond to the same steering direction, but instead of holding his hands in front of his body, he has them at a nearly relaxed position by his sides. In this instance, where two of the outputs (hand spacing and hand rotation angles) show that it is likely that the user intended to make the steering gesture, but a third output (hand position) does not, it may be determined that the user intended to perform the gesture.

Operation **1110** depicts providing assistance regarding the user-performed gesture.

In an embodiment, providing assistance comprises adjusting the output, and sending the adjusted output to an application corresponding to the user-performed gesture. This may be akin to relaxing the parameters or tolerance of an application. Where it is determined that the user intended to perform the gesture, the outputs for the corresponding gesture filter may be changed to be outputs that correspond to the gesture likely being performed, while still maintaining the user's intent. For instance, where the user appears to intend to steer a vehicle sharply to the left, but has incorrect hand position, the outputs corresponding to hand position may be adjusted, while still corresponding to the vehicle steering sharply to the left (as opposed to a turn to the soft left, or a turn to the right).

In an embodiment, adjusting the output comprises increasing a responsiveness of the filter. For instance, the user may make small movements that likely correspond to the user intending, but failing, to perform a gesture. With a steering gesture, this could comprise rotating his hands only a small amount when he wants to turn, no matter how sharply. These movements may be amplified. Where the user rotates his hands a maximum of 20°, and a rotation of 90° corresponds to the sharpest turn, the user's actual rotation may be multiplied by a factor of 4.5, such that his 20° rotation is treated as if it were a 90° rotation.

This mapping from actual movement to intended movement may be linear or nonlinear. It may be that the user correctly performs very subtle steering motions nearly correctly, and fails on the sharper turns. In this case, the responsiveness of a subtle steering motion may be increased only slightly, or not at all, while the responsiveness of a motion intended to convey sharp steering may be increased more greatly.

In an embodiment, the output is adjusted only after determining that the filter is a filter that may be adjusted. Some filters may benefit from adjustment. For instance, a user who poorly makes a "fire weapon" gesture and frequently misses his intended target may become frustrated with the controls and have a poor user experience. Thus, it may be beneficial to adjust a "fire weapon" filter to aid the user's aim, and the "fire weapon" filter can be a filter that may be adjusted. However, this may not be true for an "automobile steering" gesture. The user may steer very poorly in a conventional sense—he frequently crashes or runs off a track. However some users like to ignore the stated objectives of a scenario and intentionally perform poorly. In such a case, adjusting the "automobile steering" filter may actually damage the user experience because it prevents him from doing what he wants to do. Here, the "automobile steering" gesture may be one that may not be adjusted.

Whether or not a filter may be adjusted may be determined, for instance, by a boolean output by the filter that can be read by an entity that would adjust it, or by a boolean set in a data structure corresponding to the filter that may be read by an entity that would adjust it.

In an embodiment, providing assistance comprises replacing the filter with a second filter. For instance the user may have difficulty performing gestures associated with an "expert steering" filter, which has low tolerances for variances from the exemplary motion. This may be determined and the "expert steering" filter may be replaced with a "beginner steering" filter, which has higher tolerances for variance than the "expert steering filter." The filter may be replaced, for example, by indicating to an associated application that it is to use this new filter's output(s) in place of the former filter's output(s), or by removing the former filter from the gesture recognizer engine and in its place putting the new filter.

In an embodiment, providing assistance comprises suspending an application corresponding to the user-performed gesture. For example, where it is determined that assistance to teach the user how to properly perform the gesture should be given, it would be very difficult for the user to learn the gesture and still interact with the application. So, the application may be paused or suspended, the assistance given for a time, such as until the user has proven to be able to consistently perform the gesture, and after the assistance session, the application may be resumed.

In an embodiment, providing assistance comprises displaying the output to the user on a display device. For instance, where the output comprises the confidence level, the confidence level may be graphed versus time as the user attempts to perform the gesture. When he performs the gesture correctly, he will see the confidence level increase correspondingly, and will be able to associate those movements with correctly performing the gesture. This display may also include an indication of when that output is acceptable, such as via a color change, an alert sound, or a flash on the screen. Where the output is hand distance is graphed versus time, and the hand distance must be between 12" and 18", it may be that the graph is green where the user's hand distance is between 12" and 18", and red at all other times.

In an embodiment, providing assistance comprises displaying a representation of the user-performed gesture and a demonstration of the gesture. This may comprise displaying the two gestures side-by-side so that the user may visually identify where he is moving improperly. Additionally, where the user performs part of the gesture correctly and part of the gesture incorrectly, there may be an indication of those times the user is performing the gesture correctly, such as by playing a sound. Furthermore, the assistance may include a direct instruction regarding the differences between the two gestures, such as on-display text that reads, "Your hands must be 12-18" apart. Your hands appear to be too far apart. Try bringing them closer together."

In an embodiment, providing assistance comprises displaying a difference between the user-performed gesture and the demonstration of the gesture. This may comprise overlaying the demonstration on top of the user-performed gesture so that the differences are apparent. This may include highlighting a region of the body where the difference exists. In an embodiment, the user-performed gesture and the demonstration of the gesture are displayed differently to make them easier to individually identify. For instance, where one is overlaid on the other, the user-performed gesture may be displayed as video of the user or an avatar representation, and the demonstration may be displayed as a wire-frame avatar, or vice versa.

In an embodiment, the assistance is sourced from another user. In an embodiment, the sourced assistance is at least one from a set, the set comprising assistance that is at or near the top of a leader-board, assistance that has been rated highly, assistance that has been identified by a user that created it as being appropriate for assistance, assistance that a second user has identified as being appropriate for the user, assistance from a user of the same culture as the user, assistance from a user of the same language as the user, assistance from a user of a similar age as the user, and assistance from a user of a similar location as the user.

In an embodiment, providing assistance comprises relaxing a tolerance level associated with the filter.

FIGS. **11**B and **11**C depicts example architectures for gesture coaching **1150** integrated with a gesture recognizer engine **190** and an application **1152**.

In FIG. **11**B, both the gesture coach **1150** and the application **1152** receive the outputs of each filter **518** from each filter **518**. This architecture allows the gesture coach **1150** to monitor filter output to determine whether assistance is appropriate, while at the same time allowing the application **1152** to receive the outputs. Optionally, the gesture coach **1150** may communicate with the application **1152**, such as to send modified outputs for use by the application **1152**.

In FIG. **11**C, the gesture coach **1150** receives the outputs of each filter **518** from those filters **518**, and then passes the outputs to the application **1152**. In this architecture, the gesture coach **1150** may modify any received output before sending it to the application **1152**.

FIGS. **12**A and **12**B depict example filter outputs from which it may be determined that gesture coaching is appropriate. Each graph charts the user's hand distance over time, as from the output of a "automobile steering" gesture filter.

FIG. **12**A depicts exemplary hand distance over time of an unskilled user who has difficulty maintaining a roughly uniform hand distance as is required for the gesture to be performed. It may be determined from such output that assistance is appropriate. Likewise, where the hand distance must lie in a given range, were the user to maintain a roughly uniform hand distance, it may still be determined that assistance is appropriate if that roughly uniform distance is above or below the given range.

FIG. **12**B depicts exemplary hand distance over time of an adroit user who is able to maintain a roughly uniform hand distance as is required for the gesture to be performed. While the hand distance is not constant, the filter may allow for such variance so long as it is small enough.

Conclusion

While the present disclosure has been described in connection with the preferred aspects, as illustrated in the various figures, it is understood that other similar aspects may be used or modifications and additions may be made to the described aspects for performing the same function of the present disclosure without deviating therefrom. Therefore, the present disclosure should not be limited to any single aspect, but rather construed in breadth and scope in accordance with the appended claims. For example, the various procedures described herein may be implemented with hardware or software, or a combination of both. Thus, the methods and apparatus of the disclosed embodiments, or certain aspects or portions thereof, may take the form of program code (i.e., instructions) embodied in tangible media, such as floppy diskettes, CD-ROMs, hard drives, or any other machine-readable storage medium. When the program code is loaded into and executed by a machine, such as a computer, the machine becomes an apparatus configured for practicing the disclosed embodiments. In addition to the specific implementations explicitly set forth herein, other aspects and implementations will be apparent to those skilled in the art from consideration of the specification disclosed herein. It is intended that the specification and illustrated implementations be considered as examples only.

What is claimed:

1. A method for providing assistance regarding a user-performed gesture, comprising:

receiving data captured by a capture device, the data corresponding to a user motion or pose;

analyzing the data to produce an output corresponding to whether the data corresponds to input recognized by a system;

determining from the output that it is unlikely that the user correctly performed a user motion or pose that invokes the input recognized by the system;

determining from the output that the user likely intended to perform the user motion or pose that invokes the input recognized by the system;

adjusting the output to have a new value, the new value being more indicative of invoking the input recognized by the system than the old value is indicative of invoking the input recognized by the system; and

sending the adjusted output to an application that is configured to process the input recognized by the system.

2. The method of claim **1**, further comprising:

determining that the output may be adjusted before adjusting the output;

receiving second data captured by the capture device, the second data corresponding to a second user motion or pose;

analyzing the second data to produce second output corresponding to whether the second data corresponds to a second input recognized by a system;

determining from the second output that it is unlikely that the user correctly performed a user motion or pose that invokes the second input recognized by the system;

determining from the second output that the user likely intended to perform the a user motion or pose that invokes the input recognized by the system;

providing assistance regarding the a user motion or pose that invokes the input recognized by the system; and

in response to determining that the second output may not be adjusted, sending the second output to the application without adjusting the second output.

3. The method of claim **1**, wherein the output comprises a confidence level that the user correctly performed the user motion or pose that invokes the input recognized by the system.

4. The method of claim **3**, wherein it is unlikely that the user correctly performed the system-recognized gesture when the confidence level is below a threshold.

5. The method of claim **1**, further comprising:

suspending an application corresponding to the input recognized by the system in response to determining from the output that it is unlikely that the user correctly performed a user motion or pose that invokes the input recognized by the system.

6. The method of claim **1**, wherein the output comprises a value, and further comprising:

displaying the value of the output to the user on a display device.

7. The method of claim 1, further comprising:

displaying a representation of the user motion or pose corresponding to the data and a demonstration of the user motion or pose that invokes the input recognized by the system.

8. The method of claim 7, further comprising:

displaying a difference between the user motion or pose corresponding to the data and the demonstration of the user motion or pose that invokes the input recognized by the system.

9. A system for providing assistance regarding a user-performed gesture, comprising:

a processor; and

a memory communicatively coupled to the processor when the system is operational, the memory bearing processor-executable instructions that, when executed on the processor, cause the system to at least:

receive data captured by a camera, the data corresponding to a user motion or pose;

analyze the data to produce an output corresponding to whether the data corresponds to input recognized by a system;

determine from the output that it is unlikely that the user correctly performed a user motion or pose that invokes the input recognized by the system;

determine from the output that the user likely intended to perform the user motion or pose that invokes the input recognized by the system;

adjust the output to have a new value, the new value being more indicative of invoking the input recognized by the system than the old value is indicative of invoking the input recognized by the system; and

send the adjusted output to an application that is configured to process the input recognized by the system.

10. The system of claim 9, wherein the output comprises a confidence level the user correctly performed the user motion or pose that invokes the input recognized by the system.

11. The system of claim 10, wherein it is unlikely that the user correctly performed the system-recognized gesture when the confidence level is below a threshold.

12. A computer readable storage medium, comprising computer readable instructions that when executed on a computer, cause the computer to perform operations comprising:

receiving data captured by a depth camera, the data corresponding to a user motion or pose;

analyzing the data to produce an output corresponding to whether the data corresponds to input recognized by a system;

determining from the output that it is unlikely that the user correctly performed a user motion or pose that invokes the input recognized by the system;

determining from the output that the user likely intended to perform the user motion or pose that invokes the input recognized by the system;

adjusting the output to have a new value, the new value being more indicative of invoking the input recognized by the system than the old value is indicative of invoking the input recognized by the system; and

sending the adjusted output to an application that is configured to process the input recognized by the system.

13. The computer readable storage medium of claim 12, further comprising computer readable instructions that when executed on the computer cause the computer to perform operations comprising:

determining that the output may be adjusted before adjusting the output;

receiving second data captured by the capture device, the second data corresponding to a second user motion or pose;

analyzing the second data to produce second output corresponding to whether the second data corresponds to a second input recognized by a system;

determining from the second output that it is unlikely that the user correctly performed a user motion or pose that invokes the second input recognized by the system;

determining from the second output that the user likely intended to perform the a user motion or pose that invokes the input recognized by the system;

providing assistance regarding the a user motion or pose that invokes the input recognized by the system; and

in response to determining that the second output may not be adjusted, sending the second output to the application without adjusting the second output.

14. The computer readable storage medium of claim 12, wherein the output comprises a confidence level that the user correctly performed the user motion or pose that invokes the input recognized by the system.

15. The computer readable storage medium of claim 14, wherein it is unlikely that the user correctly performed the system-recognized gesture when the confidence level is below a threshold.

16. The computer readable storage medium of claim 12, further comprising computer readable instructions that when executed on the computer cause the computer to perform operations comprising:

suspending an application corresponding to the input recognized by the system in response to determining from the output that it is unlikely that the user correctly performed a user motion or pose that invokes the input recognized by the system.

17. The computer readable storage medium of claim 12, wherein the output comprises a value, and further comprising:

displaying the value of the output to the user on a display device.

18. The computer readable storage medium of claim 12, further comprising computer readable instructions that when executed on the computer cause the computer to perform operations comprising:

displaying a representation of the user motion or pose corresponding to the data and a demonstration of the user motion or pose that invokes the input recognized by the system.

19. The computer readable storage medium of claim 18, further comprising computer readable instructions that when executed on the computer cause the computer to perform operations comprising:

displaying a difference between the user motion or pose corresponding to the data and the demonstration of the user motion or pose that invokes the input recognized by the system.

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(54) **SYSTEM AND METHOD FOR REMOTE SIGNATURE ACQUISITION**

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See application file for complete search history.

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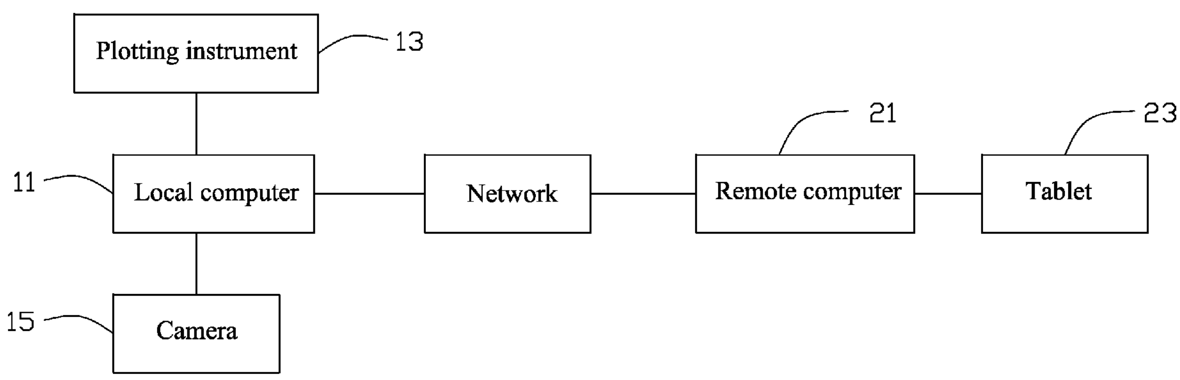
(57) **ABSTRACT**

A system for remote signature acquisition, includes a local computer located in a first position where a document is needs to be executed, a remote computer located at a second position, a camera connected to the local computer, a tablet connected to the remote computer, and a plotting instrument connected to the local computer. The remote computer is connected to the local computer via a network. The camera presents information of the document to the remote computer via the local computer and network for display at the second position. The tablet records the corresponding input thereon and converts the input to a digital signal which is capable of being transmitted to the local computer via the remote computer and network. The local computer directs the plotting instrument to inscribe the corresponding input on the document according to the digital signal.

10 Claims, 2 Drawing Sheets



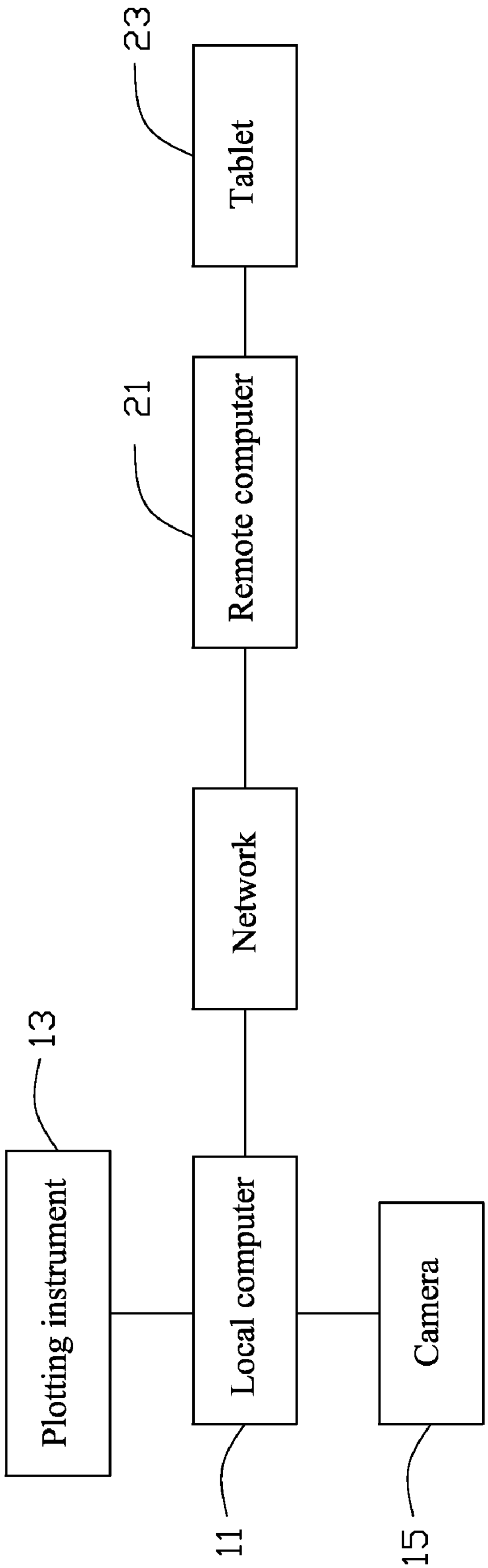

Tablet
23
Remote computer
21
Network
Plotting instrument
13
Local computer
11
Camera
15

FIG. 1

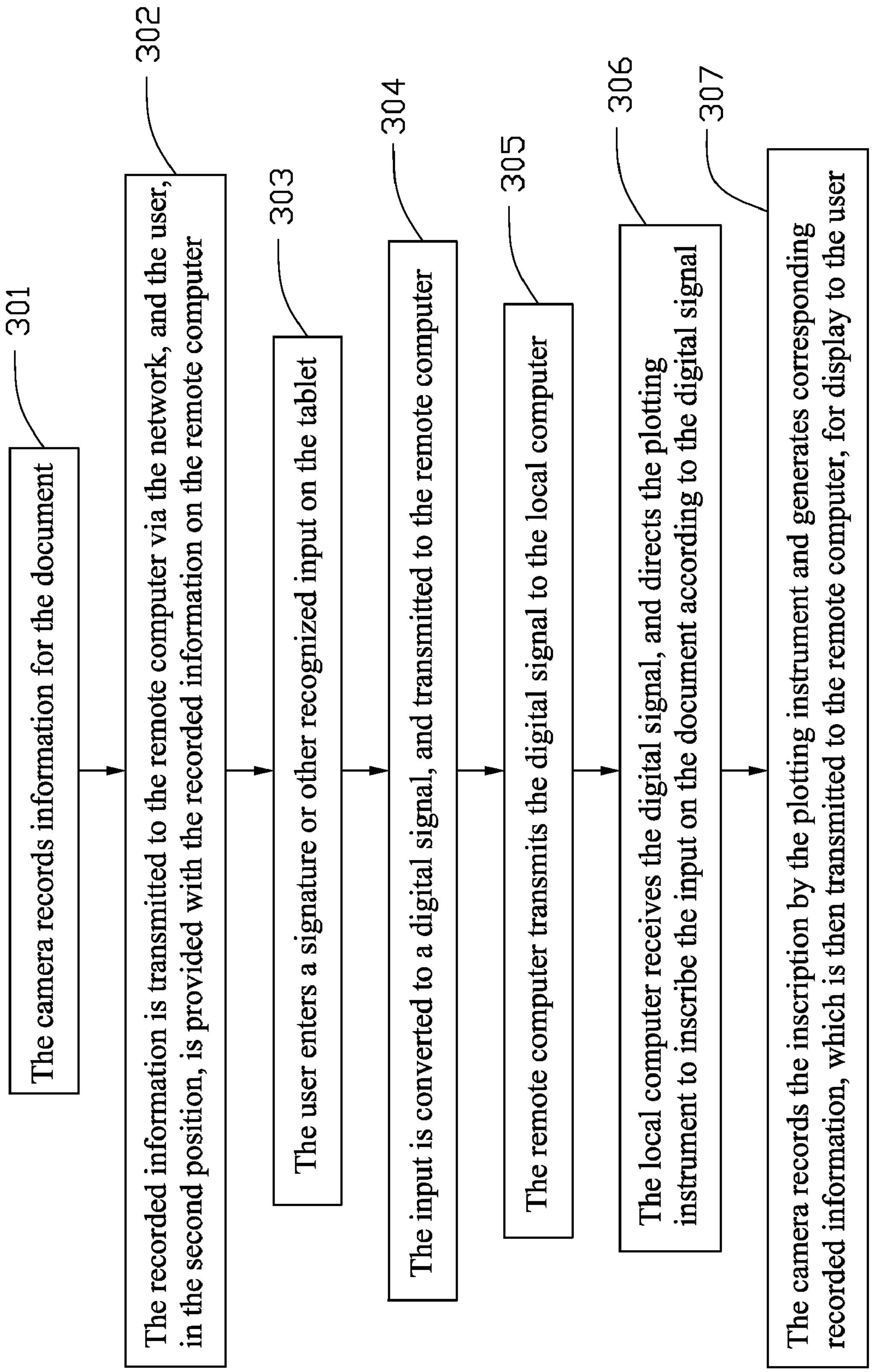

301
The camera records information for the document
302
The recorded information is transmitted to the remote computer via the network, and the user, in the second position, is provided with the recorded information on the remote computer
303
The user enters a signature or other recognized input on the tablet
304
The input is converted to a digital signal, and transmitted to the remote computer
305
The remote computer transmits the digital signal to the local computer
306
The local computer receives the digital signal, and directs the plotting instrument to inscribe the input on the document according to the digital signal
307
The camera records the inscription by the plotting instrument and generates corresponding recorded information, which is then transmitted to the remote computer, for display to the user

FIG. 2

SYSTEM AND METHOD FOR REMOTE SIGNATURE ACQUISITION

BACKGROUND

1. Technical Field

The present embodiment relates to secure signature-based access, and particularly to a system providing remote signature authorization.

2. Description of Related Art

With all the advantages of the Internet, there has been a movement to migrate many cooperative operations to the Internet. Such operations, while benefiting from the convenience and speed of the Internet, may be classified as secure and require authorization prior to access. A conventional means is use of a digital signature or other written authorization. A digital signature is typically based on asymmetric cryptography, wherein each user has a unique pair of private and public keys, duly certified by a trusted certificate authority. When a user signs a document via the digital signature, a unique mathematical code is created with the help of the user's private key. This signature can identify the user's identity by the signature's relationship to the digital certificate. However, the digital signature cannot be used with hand copy documentation.

Therefore, there is room for improvement within the art.

BRIEF DESCRIPTION OF THE DRAWINGS

Many aspects of the embodiments can be better understood with references to the following drawings. The components in the drawings are not necessarily inscribed to scale, the emphasis instead being placed upon clearly illustrating the principles of the embodiments. Moreover, in the drawings, like reference numerals designate corresponding parts throughout the several views.

FIG. **1** is a block diagram of a system for remote signature acquisition; and

FIG. **2** is a flow chart of a method for remote authorization acquisition.

DETAILED DESCRIPTION

Referring to FIG. **1**, a system for remote signature acquisition includes a local computer **11**, a camera **15** connected to the local computer **11**, a plotting instrument **13** connected to the local computer **11**, a remote computer **21**, and a tablet **23** connected to the remote computer **21**. The local computer **11** is located in a first position where a document is located, and the remote computer **21** is located in a remote second position where a user is located. The local computer **11** and the remote computer **21** are connected via a network, such as the Internet.

In the present embodiment, the local computer **11** and the remote computer **21** can be personal computers, servers, or other portable terminals. The camera **15** provides high definition image capture. The plotting instrument **13** is controlled by the local computer **11**. The tablet **23** accepts user input which is then converted to digital information.

Referring to FIG. **2**, in use, the camera **15** records information for the document (step **301**). The recorded information is transmitted to the local computer **11**, which transmits the recorded information to the remote computer **21** via the network. The user, in the second position, is provided with the recorded information on the remote computer **21** (step **302**). The user enters a signature or other recognized input on the tablet **23** (step **303**). The input is converted into a digital signal, and transmitted to the remote computer **21** (step **304**).

The remote computer **21** then transmits the digital signal to the local computer **11** (step **305**). The local computer **11** receives the digital signal, and directs the plotting instrument **13** to inscribe the input on the document according to the digital signal (step **306**). The camera **15** records the inscription by the plotting instrument and generates corresponding recorded information, which is then transmitted to the remote computer **21**, for display to the user (step **307**).

In the above embodiment, for security, the remote computer **21** can encrypt the digital signal before transmission thereof to the local computer **11**. If the document has a plurality of pages, the system is equipped with a page turning apparatus to turn the pages of the document. The system is further equipped with a robot arm to move the document for the camera to conveniently record the document and the plotting instrument inscribing the input in the correct place of the document.

It is to be understood, however, that even though numerous characteristics and advantages of the embodiments have been set forth in the foregoing description, together with details of the structure and function of the embodiments, the disclosure is illustrative only, and changes may be made in detail, especially in matters of shape, size, and arrangement of parts within the principles of the present disclosure to the full extent indicated by the broad general meaning of the terms in which the appended claims are expressed.

What is claimed is:

1. A system for remote signature acquisition, comprising:

a local computer located in a first position where a document to be inscribed;

a remote computer located at a second position, the remote computer connected to the local computer via a network;

a camera located in the first position and connected to the local computer, the camera capable of presenting information of the document to the remote computer via the local computer and the network;

a tablet located in a second position and connected to the remote computer, the tablet being capable of recording an input written on the tablet and converting the input to a digital signal, and the table being adapted to transmit the digital signal to the local computer via the remote computer and the network; and

a plotting instrument located in the first position, the plotting instrument being connected to and directed by the local computer, the plotting instrument being adapted to inscribe the input on the document according to the digital signal.

2. The system of claim **1**, wherein the remote computer is capable of encrypting the digital signal before the digital signal is transmitted to the local computer.

3. The system of claim **1**, further comprising a page turning apparatus capable of turn the pages of the document.

4. The system of claim **1**, further comprising a robot arm to relocate the document for the camera to record the document information and the plotting instrument to inscribe the signature on the document in a desired location.

5. The system of claim **1**, wherein the local computer or remote computer is a personal computer, server, or portable terminal.

6. The system of the claim **1**, wherein the camera is capable of recording the information of the document, and transmitting the information to the remote computer via the local computer and the network for displaying at the second position.

7. A remote signature acquisition method, comprising steps in an order as follows:

providing a camera, a local computer, a tablet, a plotting apparatus, and a robot arm;

placing a document in front of the camera by the robot arm;

recording information of the document by the camera;

transmitting recorded information of the document from the camera to a remote computer;

connecting the tablet to the remote computer;

inputting a written signature on the tablet corresponding to the recorded information received by the remote computer;

converting the written signature into a digital signal;

sending the digital signal to the local computer; and

controlling the plotting apparatus to inscribe the written signature corresponding to the digital signal on the document by the local computer.

8. The method of claim **7**, wherein after the step of controlling the plotting apparatus and inscribing the written signature, the camera records the inscribed written signature.

9. The method of claim **7**, wherein before the step of sending the digital signal to the local computer, the remote computer encrypts the digital signal.

10. A remote signature acquisition system, comprising:

a local computer, a document, a camera, a robot arm, and a plotting instrument located in a first position; both the camera and the plotting instrument are connected to the local computer; the robot arm is adapted to place a document in front of the camera; and the plotting instrument is adapted to inscribe on the document;

a remote computer and a tablet located in a second position, the remote computer being connected to the local computer via a network, the tablet being connected to the remote computer;

wherein the camera is adapted to present information of the document to the remote computer via the local computer and the network; the tablet is adapted to record an input written on the tablet; the tablet is further adapted to convert the input to a digital signal and to transmit the digital signal to the local computer via the remote computer and the network; and the local computer is adapted to direct the plotting instrument to inscribe the input on the document according to the digital signal.

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Baker v Microsoft Corporation; et al., 17-1928

PROOF OF SERVICE

I hereby certify on June 5, 2017, I sent one copy of Appellant's Opening Brief Appendix, by Electronic Email to:

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